RAILROAD GAZETTE

SATURDAY, JULY 17, 1875.

Engine Truck Wheel with Steel Tire.

The method of attaching steel tires to cast-iron wheel centers, now extensively used on the Baltimore & Ohio Railroad, is represented very clearly in the engraving herewith. The tires are put on with a "tapered fit" and are held on with hook-head bolts, which are let into recesses cast in the wheel centers. We have before called attention to this method of applying tires to driving-wheels, which is employed on all the engines of this road. The officers report that during the whole of last winter, which, it will be remembered, was an exceptionally severe season and during which an unusual number of breakages of locomotive tires occurred on nearly all roads, but two tires were broken on their whole line, which is equipped with nearly 400 engines. This immunity from this kind of accident is attributed to this method of fastening tires, which certainly has very much to recommend it. Not the least advantage is the facility with which tires can be put on and taken off, which can be done without removing the wheels from under the engine and in very much less time than is possible if they are shrunk in. It seems, for these reasons, to be admirably adapted for engine truck wheels.

Contributions.

The Actual Cost of Keeping Car Mileage.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice in your valuable paper of January 2, 1875, an article headed "Does it Pay to Keep Car Mileage?"

I have been waiting to see if some of your able contributors would not answer the question, but as no one has taken up the subject, I propose to furnish a few facts and figures, still leaving the question of "does it pay to keep car mileage?" for some one more experienced than myself to answer. Below I give you, as near as possible, the exact cost of keeping the mileage of 301 passenger, baggage, mail, express, drawing-room and sleeping cars used on the Succoth & Zaradatha Railroad, also the system by which the mileage is kept. It is necessary to introduce some blanks in order to illustrate the system.

Blank No. 1 (see description of its form below) is for the use of conductors running one or more local trains. The lower part of the blank is to report cars left at or taken on between the terminal stations.

Blank No. 2 (see blank) is for the use of conductors running express trains who are liable to have drawingroom and sleeping cars attached to their trains. The conductors are required to send in the above blanks with their cash report to the general office daily. They are then separated and sent to the person keeping the car mileage. Blank No. 3 (see Blank) represents the book that the car mileage is recorded in. We use three books for convenience of recording, one for baggage, mail and express cars, one for passenger cars, and one for drawing-room and sleeping cars. We have running 15,843 regular passenger trains per year. The extra trains I cannot give, as they vary according to circumstances. The conductors running regular trains require 12,540 Blanks No. 1 and 2 for a year's business; at a cost of five dollars per thousand. Blanks No. 31, representing books to record the mileage, cost as follows: Baggage, mail and express car book, $8.50; passenger car book, $12.00; drawing-room and sleeping-car book, $9.50, and are good for two years' business. We also require 352 envelopes for forwarding the conductors' mileage Blanks No. 1 and 2, at a cost of $3.52 for the year. It requires 1,565 hours' labor per year to record the mileage, foot up the mileage of each car, and do the necessary labor of filing away the blanks, etc., at 22½ cents per hour, making a total cost as follows:

12,540 blanks, Nos. 1 and 2, @ $5.00 per 1,000	$62 70
One-half of baggage, mail and express car book	4 25
One-half of passenger-car book	6 00
One-half of drawing-room and sleeping-car book	4 75
352 envelopes for forwarding blanks Nos. 1 and 2	3 52
1,565 hours' labor recording mileage, etc., @ 22½ cts	352 12½
	$433 34½

I will now give you the cost of keeping the mileages of car wheels under the above cars and the system by which it is kept. In order to illustrate, I shall have to introduce some blanks. Combining the wheel report with the car mileage, giving as near as possible the actual cost and the results obtained by so doing, I will now introduce Blank No. 4 (see blank), which is furnished to all the principal foremen on the road, also to the head car inspectors at places where there are no shops, but where wheels are changed.

It will probably be well to explain some of the headings on Blank No. 4. The columns headed "No. of axle" denotes its position under the car, and are numbered as follows for cars with four axles: 1, 2, 3, 4; for cars with six axles, 1, 1½, 2, 3, 3½, 4; for cars with eight axles, 1, 1¼, 1½, 2, 3, 3¼, 3½, 4.

The above numbers can be stamped on the wheel piece above the pedestal or jaw, or on the safety beams of each truck. All wheels when taken out are marked with paint, giving the location in the car they came from. (Thus, for instance, you change the wheels on axle No. 3, in car No. 197. The numbers of the wheels are already in paint on each wheel, the class of car and number of axle.) These wheels are marked in this way so that in case of dispute any error can be traced. These wheels may have been taken out for some defect in the axles after running a few miles: in that case they would probably be put in a new axle and put under some other car, and in order to keep the accurate mileage it would be necessary to know what car they came from, in order to report them in the column under the head of "Under what car had the second-hand wheels been run before." When these wheels are put under again we paint off with black paint the name and number of car and number of axle.

These blanks are sent from the foreman or car inspectors to the person keeping the wheel mileage. At the end of each month I have filled out a Blank No. 4, so that your readers can see its full use. Blank No. 5 (see blank) is used when Blank No. 4 is not required. By using Blank No. 5 in combination with No. 4, the person keeping the wheel mileage knows when all his reports are in at the end of the month, as he cannot very well begin to figure up the mileage until all the reports are in. We have on our road six different places where wheels are changed, and if wheels are changed at each of the above places, we require about 110 No. 4 Blanks per year at $10.00 per thousand. Blank No. 5 I shall have to estimate at 25 cents per year, as it depends altogether on how many are used. Blank No. 6 represents the wheel record book, and costs $18.00, and I should judge it will last six years, but that depends altogether on how often you have to change wheels. I base my judgment on the past year's experience with an old book. We require 626 hours' labor per year at 22½ cents per hour to keep the account of each wheel, make out the reports at the end of each month, and do what other work is necessary to be done throughout the month appertaining strictly to the wheel account. The following is the cost of keeping the wheel mileage for one year:

110 blanks No. 4, @1c	$1 10
Blanks No. 5 for one year	25
72 envelopes, @1c	72
Use of wheel mileage book for one year	3 00
626 hours' labor keeping mileage of wheels for one year, @22½ cts	140 85
Total	$145 92
Cost of keeping mileage of cars for one year	433 34½
Total cost of keeping mileage of cars and mileage of wheels for one year	$579 24½

Below I send you a report of the mileage of iron wheels of A, B, C, and D, makers, kept by the above system, for the year ending March 31, 1875:

We took out A, B, C and D wheels as follows: 156 wheels, maker's name A, which ran 4,602,318 miles, the least mileage for any one wheel being 3,003 miles, and the greatest mileage for any one wheel being 82,368 miles, the average number of miles run per wheel being 29,502 1-156. Of maker B, we took out 424 wheels, the total miles run being 13,966,858, the least mileage of any one wheel being 3,224 miles, the greatest mileage for any one wheel being 78,938 miles, the average mileage of B's wheels being 32,940 298-424 miles. We took out 64 of C maker's wheels which ran 2,166,932 miles, the least number of miles ran by any one wheel being 10,062, and the greatest number of miles run for any one wheel being 73,710, while the average number of miles run per wheel was 33,858 20-64. We also took out 64 wheels, maker's name D, of which the total miles run were 986,726, the least number of miles run by any one wheel being 1,360, and the greatest number of miles run by any one wheel being 45,630, making an average number of miles run per wheel 15,417 38-64. These make the total number of A, B, C and D's wheels taken out 708, the total miles run being 21,722,829, and the total average of A, B, C and D's wheels being 30,681 681-708 miles per wheel. Below I give you a recapitulation in order that your readers may see the results more readily:

MAKER'S NAME OF WHEEL.	Number of wheels taken out.	Total miles run.	Least number of miles run for any one wheel.	Greatest number of miles run for any one wheel.	Average number of miles run per wheel.
Maker A...	156	4,602,313	3,003	82,368	29,502 1-156
" B...	424	13,966,858	3,224	78,938	32,940 298-424
" C...	64	2,166,932	10,062	73,710	33,858 20-64
" D...	64	986,726	1,360	45,630	15,417 38-64
Total...	708	21,722,829	......	......	30,681 681-708

BOAS.

DESCRIPTION OF BLANKS REFERRED TO ABOVE.

Blank No. 1 is for the conductors report, and contains spaces for the number of baggage cars and another for the passenger cars. Below these are headings under which is a column for the number of cars which are left, and another heading for those of cars taken on during the run, with a column for the names of stations, at which the hot boxes are to be noted. These blanks are printed on both sides of the paper, so that the report for the train running in one direction is made out on side and the return trip on the other.

Blank No. 2 is similar to the above, with the exception that it has spaces for drawing-room and sleeping cars.

Blank No. 3 has simply a column on the right margin for the days of the month, and successive columns to the left for each car, with four lines for each day, in which the mileage of cars is to be entered.

Blank No. 4 has columns with the following headings:

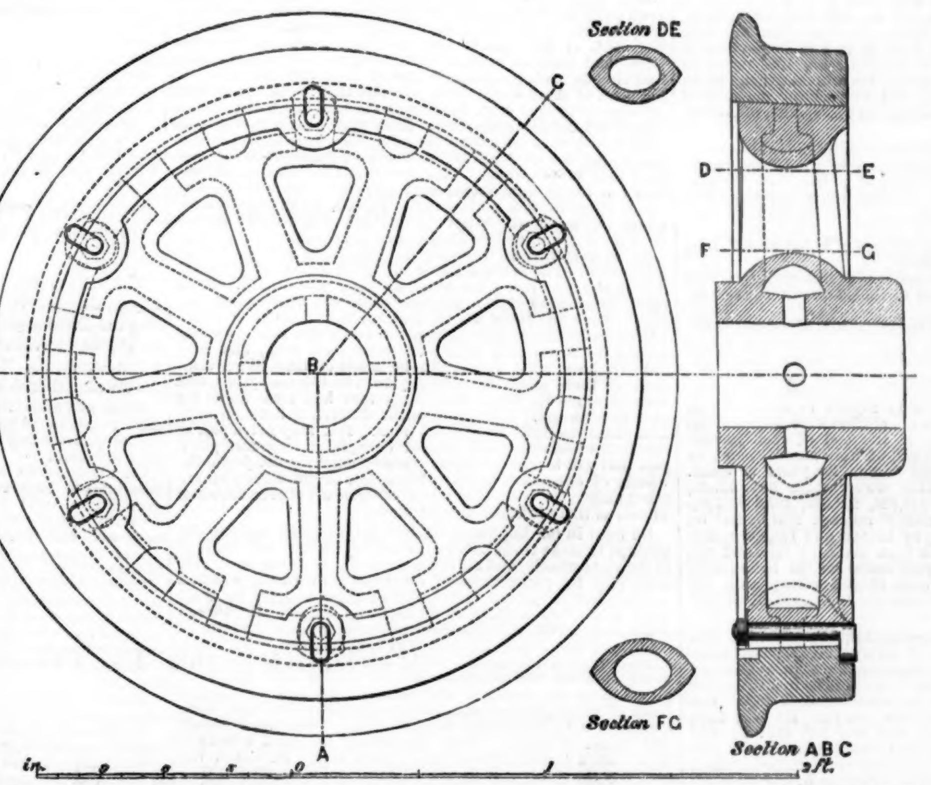
Name and number of car.
Number of axle.
Number of wheel and mate taken out.
Kind of wheel taken out; teel or iron.
Maker's name of wheel taken out.
Date taken out.
Cause for taking out. Explain in full.
Number of wheel and mate put in.
Maker's name of wheels put in.
Date put in.
New or second-hand wheels put in.
Old or new axles.
Kind of wheels put in; steel or iron.
Had the second-hand steel wheels put in been newly turned off?
Under what car had the second-hand wheels been run before?

Blank No. 5 is simply a notice that no wheels have been changed during the month.

Blank No. 6 has columns with the following headings:

Name and number of car.
Number of wheel put in.
Date put in.
At what shop put in,
Maker's name.
New or second-hand?
Steel or iron?
Had the second-hand wheels been newly turned off?
Under what car had the second-hand wheels been run before?
Date taken out.
Cause for taking out.
Weight of car.
Number of miles run under other cars before turning off.
Number of miles run under other cars before first turning off.
Number of miles run under other cars before second turning off.
Number of miles run under other cars before third turning off.

Then are also columns for each month to receive the mileage of the wheels, another for the total for year, and the last one is for the grand total.



ENGINE TRUCK WHEEL WITH STEEL TIRE, USED ON THE BALTIMORE & OHIO RAILROAD.

MASTER CAR BUILDERS' ASSOCIATION.

Ninth Annual Convention.

We continue our report of the proceedings, beginning herewith the opening of the third day's session:

The Committee on Car Wheels, Best Method of Fitting, Flange Wear and Causes, Mileage and Breakage, being called on for a report,

Mr. KIRBY said that he was on that committee, but that the

Chairman was not there and had sent no report. He had no time, after hearing that the chairman was not coming, to prepare a report. He asked that a new committee be appointed.

Mr. DAVENPORT thought Mr. Kirby's reasons were good and moved that the verbal report be received and a committee reorganized.

The motion was then carried,

Mr. CHAMBERLAIN hoped that there would be some discussion, and that the members would take hold this year and introduce the system of keeping mileage as far as they could. Then they would have some facts to go upon.

Mr. KIRBY said the committee had received only seven replies to the circulars.

Mr. CHAMBERLAIN thought there was some excuse for members not sending statistics, as many of them had no chance to procure them. There are blanks that could be introduced on railroads without much trouble, from the use of which car-builders would be able to get the mileage of any wheels introduced by them. If every master car-builder will see, during the coming year, what he can do in that line, they would have at the next meeting a valuable report. It is rather embarrassing to those who have not had as much experience in science as the master car-builders have had, to look over a report made by a committee of civil engineers, who came over here some time in 1874, to investigate our system of railroads. He had some English commentaries upon American railroad practice. He read an extract from the paper of C. D. and F. Fox, read Nov. 24, 1874, before the Institution of Civil Engineers of England, on the Pennsylvania Railway of the United States, and and American Railway Construction:

"The trucks of the engines have chilled cast-iron wheels. Steel wheels have been tried, but it was found that they would not bear the severe work of guiding the locomotive over the sinuosities of the line. Solid cast wheels with the running surface chilled, are the safest, especially in cold weather, a truck-wheel of this kind rarely breaking, and one such wheel outliving at least three steel wheels. Again, the flanges of chilled wheels are soon made smooth and highly polished by wear, while the flanges of steel wheels become rough and torn, and, in a short time, too thin and sharp for safety. Chilled cast wheels are also extensively used for the rolling-stock, steel tires having been tried for the passenger-cars, but have quickly become dangerous for rapid wear. The weight of a cast-iron wheel for a passenger-car is usually 525 pounds; it costs about £4 sterling, and has an average life of at least 100,000 miles. The metal is charcoal iron, having a tensile strength sometimes reaching 18 tons per square inch.

"In the discussion, Mr. C. D. Fox said, as to the question of cast chilled wheels, he had heard no difference of opinion, either in America or Canada. He was present when attempts were made to break up some of the wheels, and he was greatly surprised at their tenacity. It seemed more like trying to break wrought-iron than cast-iron. For wheels which, as in the case of the leading trucks, had to perform the duty of guiding the train, there was nothing, in the opinion of American managers, like cast-iron."

Probably Mr. Fox and those who were with him did not suppose that there was any other railroad in the United States except the Pennsylvania. He thought if they had traveled over the country and inquired of some other railroads, they might have obtained a little different information from what they have here stated.

He had a recapitulation of the mileage of 22,004 wheels, nine different makers being represented.

He then read the tables of the mileage of iron and steel-tired car wheels, which were published in the *Railroad Gazette* for June 19, page 262.

His wheel-book showed the cause of failure of every wheel, whether by its flange, by flattening, by wearing out, or otherwise. He had a few more statistics of steel wheels, but probably it would be as well not to say anything about them. The wheels referred to in his statement run under passenger equipment. He was somewhat radical in regard to steel wheels. He could not give the average on wheels that were still running. They only figure up the average at the end of each month. The wheels that he was going to call off were running, and, so far as he could judge, were likely to run for years to come. They were steel-tired wheels. Here are six which have made, respectively, 175,474, 107,554, 119,726, 204,982, 187,358, 129,-379 miles; 92,000 miles is the smallest mileage that he had on the list. From that they run up to 100,000 and 175,000 miles. Those are the mileages that had been made so far, and the wheels are still running. One pair made 134,922 before they were turned, and after the first turn 192,354 miles; after the second turning, 50,268 miles; making an aggregate of 377,614 miles, and they are still running.

Another lot made before turning 134,992; after the first turning, 180,467; after the second turning, 50,620: total mileage, and still running, 366,079. That was the highest mileage. They had them all the way up from 337,000 to a little over 400,000. Some of them had been running since 1870. The cause of failure of steel wheels was known. He had been active in introducing steel wheels and had felt that he had some reputation at stake, and had therefore been very particular in getting information in regard to the failures, which amounted in all to 102. There were probably over 3,000 steel-tired wheels running on the road he represented. The smallest mileage made by any one of them was 9,300 miles, and the greatest of any one that has yet failed was 251,416 miles. The average is 103,325. The price of the wheels was $50 each. With respect to the causes of failure, he would say that they probably did not all know how the steel was manufactured. The ingots that these tires are made out of were originally made by pouring the ingot into a mould. On breaking them it was found that there were little flaw-holes all through them. The ingot was hammered out while hot, and each and every one of these holes, instead of causing a round hole, made a seam. Consequently the steel was not perfect. No matter how solid the cast-iron was welded, it was imperfect, and so long as there was one of those imperfections in the steel, just so sure would they eventually give way. Every one of those wheels failed from that cause, although some made as high as 251,416 miles, while others made only 9,300 miles. He had every wheel which failed broken up, and found this defect to exist in the steel, and the tire broke from that cause. That defect had now been entirely done away with. Ingots were now made as solid as could be, and perfect in all their parts. Last Winter, while they were breaking 43 and 44 cast-iron wheels per month, they introduced these wheels, and run them on the New York & Boston express line, and they had not yet had a failure, and some of them had run as high as 90,000 miles since that time.

Mr. FORD asked what was the manner of breakage.

Mr. CHAMBERLAIN said that sometimes the wheel, no matter whether the flaw was close to the edge or not, would break right off at that place. Sometimes a V-shaped piece would break out, and others would scale on the tread. A scale about the thickness of a piece of paper would come off on the edge of the wheel. They could have turned them off and run them again, but did not, for they knew that the wheel, sooner or later, would do it again. There is something remarkable about steel wheels. No serious accident has ever happened because of their giving out on the road. You can find the injury quicker than you can in a cast-iron wheel, and the steel wheels will carry you better after they are broken than a cast-iron wheel will, even when it seems to be perfect. This he knew from practical experience. There is no guarantee. The maker does not wish to sell wheels unless the purchaser will pay enough to pay the interest on the money.

Mr. S. F. GATES asked what experience had been as to the breaking of steel wheels. He had always found that steel had broken where there was a weak spot. He spoke of a steel rail on the Boston & Worcester road, which had broken at a point where the flange was punched out for a spike. He then tried some experiments with the rails and found that wherever they were nicked with a cold chisel they would break from a blow. The ingots were sometimes made unsound. The steel-maker should know just what the condition of the steel was before he made his ingot. The experienced steel maker knew what his ingot was before he used it. The cause of breakage in bars of steel is the vibration which is concentrated at one spot.

Mr. CHAMBERLAIN said that he knew positively that the ingots were now made perfect. He had seen 50 of them weighed, and they did not vary a quarter of an ounce.

Mr. DAVENPORT had taken some pains to inform himself as to the relative merits of iron and steel wheels. He had also urged the necessity of keeping a mileage record, so that they could determine which were the best for service. If mileage records were not kept, the companies will be apt to buy the cheapest wheels they can get. Human nature was very much the same the world over, and men would be tempted to make cheap wheels whenever they could sell them at a good profit. But if railroad companies could be persuaded to keep an accurate mileage account of all the wheels they use, then they might hope that good wheels will be used instead of cheap ones. They had had a statement of the performance of wheels on the Boston & Albany road. Were they to conclude that this road had among the nine makers of its wheels the best makers of the country; or that possibly they had some of those wheels that were made before the remedy for flaw-holes in ingots was discovered? A railroad company known to them all had been giving this subject careful attention for the past two years. They had kept a mileage record, and he had been interested in examining that record, because he knew from the manner in which it was kept that the results obtained were correct. He found, from an examination made previous to January 1, 1875, and which had been published over the official signature of the company, that the failed wheels showed an average of 50,000 miles. He meant by failed wheels those that they had been called upon to replace. The wheels were in use by that company under its heaviest equipment, and were run at a very high rate of speed. A few of the wheels had made as high as 200,000 or 300,000 miles. These were not steel wheels, but only common cast-iron wheels, which, according to the record of his friend, only make an average of 33,000 miles. Yet, according to the careful records kept by this company—and he knew of no company in the United States more accurate—these miserable cast-iron wheels had been guilty of making over 200,000 miles, and were going on to 300,000. He noticed that the wheels of one maker—making 20 per cent. of the wheels that have been taken out up to this time—had made an average of 50,000 miles, and some of them had already made a mileage record of about 200,000 miles; 80 per cent. of them were still in use, and they do not know what mileage this 80 per cent. would make before they failed. These wheels did not cost $50 apiece. They were wheels that cost $19 apiece, and when they were worn out, they were turned over to the maker for $9 50, thus making the actual cost to the company only $9 50 a wheel. This service, as he had stated, was under a heavy equipment, such as palace cars and sleepers, which were run at the highest rates of speed. He knew something about the use of the wheels of the same maker, under freight equipment. Perhaps gentlemen had not considered the difference in performance between the passenger and the freight equipment. The average life of the failed wheels of this make during the past six years was four years and a half, and the official statement of the mileage made was 27,500 miles per year. Thus the failed wheels had made a mileage of about 120,000 under the freight equipment, and 10 per cent. only had failed; the 90 per cent. were still doing their work, and they did not know what report will be made of that 90 per cent. Some of those wheels had already been in use nine years, and were still good. These were facts that had come under his own observation. There is as much difference between cast-iron wheels as there is between men. You may get a pair of cast-iron wheels that will be poor enough, and you may get a pair that will be good enough. Gentlemen must not judge the wheels of one maker by the performance of the wheels of another maker, for there is as much difference between cast-iron wheels as there is between steel wheels.

He went in for improvement, but he protested against any attempt to make them believe that all the virtues are centered in the steel wheels, and all the vices in the cast-iron ones. He knew that the performance of some cast-iron wheels was bad enough, but it was not fair to thrust those samples in their faces as the performance of *the* cast-iron wheels. If railroad companies would buy the best cast-iron wheels that can be made, and would pay the cost of production, and 10 per cent. to cover the contingencies—which, in many cases, he was sorry to say, they are not willing to do—we should have less complaint about the failure of iron wheels. He had intended to speak of the experience of a railroad company who have been keeping a mileage account, and have been testing steel wheels with cast-iron wheels. They had tested the steel wheels to their entire satisfaction—so the report said. He asked the company the result of their experiments, and was told that they would not buy another steel wheel. He inquired what kind of a steel wheel they objected to, and they said the steel-tired wheel.

He thought they should try to persuade their railroad officials to keep a record of mileage, and he thought that when they did it carefully they would be surprised to find that there is as much difference in the performance of cast-iron wheels as there is in that of steel wheels. He was confident cast-iron wheels can be made that will give entire satisfaction at the smallest possible cost; but if they went in for a cheap wheel to begin with, they must take the consequences.

Mr. CHAMBERLAIN said that he had brought his statistics to show what the different makers were doing, and he attributed the poor mileage of the cast-iron wheels to the fault of the makers. There were good, honest iron wheels made, but they were few and far between. He thought his results would compare favorably with anything that had been shown, with regard to iron wheels. His only interest was to get the best wheel for the least money, and he advocated the steel wheel because he thought it was a good thing, and he thought that they would all have to come to it. The best manufacturers of cast-iron wheels would have to come to it. There was a reform which they all needed to help forward, and in which they could all do something; it was to aid the best cast-iron wheel manufacturers to run out the poor trash. He had a table there of 824 wheels, which had made an average of 39,762 miles; and another table, of 592 wheels, which had made an average of over 63,000 miles; and another table, of 31 wheels, which had made an average of 28,000 miles. These were steel wheels, while all that they could get out of the 2,204 iron wheels, from nine different makers, was an average of 33,805 miles. That they had done no more could not be the fault of any one maker.

Mr. ADAMS thought the road referred to by Mr. Davenport was the Lake Shore. That road had a foundry of its own, but also bought a great many wheels of other makers. These foreign wheels, he thought, did not average 50,000 miles, while its own wheels averaged 55,000 miles. The Boston & Albany did not select poor iron wheels to run against steel wheels. No maker could make uniformly good wheels; the chill was not always perfect, and there would be soft spots. He believed steel wheels were the best, but had no idea that iron ones were going out of use. No one would pay $50 for a steel wheel to put under a freight car with its comparatively small mileage. He had never known an accident caused by the breaking of a steel wheel, for they gave warning before they broke. If a wheel could be produced for $50 that would run 400,000 miles and be safe, it should be preferred. On the New Haven road, where they examined everything very carefully, they had adopted the steel wheels for all their passenger cars. They could get $25 for every steel wheel that failed, while Mr. Kirby had told him that he only got $26 per ton for old iron wheels, and that they had hundreds they would like to sell.

Mr. HOLMES said that some reference had been made to flat spots that sometimes came where no brake had been applied. He would like to ask whether they came on the same place on both wheels on the same axle, and whether those wheels were of the same diameter. He thought that if they took trouble to have both wheels of the same diameter there would be no trouble with flat spots.

Mr. ADAMS said that there was another advantage of steel wheels; you could turn them up perfectly true. In 3,000 steel wheels they had never had a flat spot, and they had hills where they used the brakes a good deal.

Mr. HILDRUP had made cast-iron wheels for 25 years, but was not satisfied with the result. He hoped they could have a fuller discussion next year.

Mr. MYERS asked whether steel wheels wore the rails more than iron.

Mr. ADAMS could not say definitely, but thought he would have known of it, if such had been the case.

Mr. HOPKINS suggested to the committee that some experiments be made to ascertain whether a car with steel wheels pulls harder or easier than one with iron. He would also suggest a plan of inspection of cast-iron wheels which he had found exceedingly useful, and that is by examining the wheels by getting under the car and looking at the plate on the inside of the wheel in order to discover whether it is cracked or not. He had, during the past winter, discovered seven cracked wheels by that means, where the hammer failed to give the slightest indication of a crack. As an experiment, he once ran a wheel cracked in that way from Paterson to Buffalo and back twice, going with the car himself and watching it at every station. It was run on a way train. He knew, therefore, that those cracks can exist for a considerable time without discovering themselves by the use of the hammer. His own observations satisfied him that a crack in a cast-iron wheel can always be discovered a good while before the wheel fails. He was satisfied that cast-iron wheels do not fail all at once.

Mr. ADAMS asked whether there were not many cares where a wheel had apparently failed all at once.

Mr. HOPKINS said he never knew of such a case where this system of inspection was adopted.

Mr. WIERS said they had four steel wheels broken last year, two under Pullman cars and two under passenger caas. The first wheel ran about two months, and then an inspector knocked a hole in it. They found a flaw inside. They took that one out, and then they found another cracked right across the tread. One of the Pullman cars broke a wheel near a station; the break was close to the flange.

On motion, the discussion was then closed.

The PRESIDENT then announced Messrs. John Kirby, I. W. Van Houten and W. E. Chamberlain as the Committee on Car Wheels, etc., for the ensuing year.

(TO BE CONTINUED.)

Premiums to Locomotive Runners and Firemen.

The following general order has been issued by Mr. J. D. Layng, General Manager of the Pennsylvania Company, operating the Pittsburgh, Fort Wayne & Chicago, the Erie & Pittsburgh, the Cleveland & Pittsburgh, the Ashtabula, Youngstown & Pittsburgh, the Mansfield, Coldwater & Lake Michigan, and the Toledo, Tiffin & Eastern railroads:

From and after the 1st day of May, 1875, premiums will be paid to engineers and firemen on all lines operated by this company, according to the specifications and regulations hereinafter set forth.

On all divisions except Cleveland & Pittsburgh, monthly premiums to engineers and firemen showing best results for preceding month:

On through passenger engines, premium to engineer $20, and to fireman $10, per month.

On local passenger engines, premium to engineer $20, and to fireman $10, per month.

On standard freight engines, 16 by 24 cylinder, first premium to engineer $20, and to fireman $10, per month; second premium to engineer $15, and to fireman $7.50, per month.

On all other freight engines, rated as one class, premium to engineer $20, and to fireman $10, per month.

On Erie & Pittsburgh freight engines, premium to engineer $20, and to fireman $10, per month.

Annual premiums to engineers and firemen showing best average results for preceding year:

On through passenger engines, premium to engineer $100, and to fireman $50, per annum.

On local passenger engines, premium to engineer $100 and to fireman $50, per annum.

On standard freight engines, 16 by 24 cylinder, first premium to engineer $100, and to fireman $50, per annum; second premium to engineer $75, and to fireman $37.50, per annum.

On all other freight engines, rated as one class, premium to engineer $100, and to fireman $50, per annum.

On freight engines, on Erie & Pittsburgh Division, premium to engineer $100, and to fireman $50, per annum.

On Cleveland & Pittsburgh Division. Monthly premiums to engineers and firemen on Main Line, and to engineers and firemen on River Division, showing best results for preceding month:

On passenger engines, premium to engineer $20, and to fireman $10, per month.

On freight engines, premium to engineer $20, and to fireman $10, per month.

Annual premiums to engineers and firemen on Main Line, and to engineers and firemen on River Division, showing best average results for preceding year:

On passenger engines, premium to engineer $100, and to fireman $50, per annum.

On freight engines, first premium to engineer $100, and to fireman $50, per annum; second premium to engineer $75, and to fireman $37.50, per annum.

REGULATIONS FOR DETERMINING RESULTS.

In case of passenger engines, award of premiums to be based on the lowest cost per car hauled one mile; in case of freight engines, on lowest cost per loaded car hauled one mile.

Results for distribution of premiums to be taken from monthly and annual printed reports of performance of engines.

A mileage of 1,500 miles to be made each month to entitle to monthly premium, and an aggregate of 18,000 miles a year to entitle to annual premium.

In calculating mileage of freight cars, five empty will be counted as three loaded cars.

The following will show the number of monthly premiums to be paid and the divisions of power competing in each case:

One for through passenger engines on Eastern Division, competing with each other, embracing the through passenger runs between Allegheny and Crestline.

One for local passenger engines, embracing all the local passenger runs between Allegheny and Crestline, Allegheny and Erie, New Castle and Ashtabula, and Mansfield and Toledo.

First and second for standard freight engines running on the lines east of Crestline, operated by Eastern Division power.

One for other freight engines running on the lines east of Crestline, operated by Eastern Division power.

One for other freight engines running on Erie & Pittsburgh line proper.

One for through passenger engines running between Crestline and Chicago.

One for local passenger engines running between Crestline and Chicago.

First and second for standard freight engines running between Crestline and Chicago.

One for other engines running in freight service between Crestline and Chicago.

One for passenger engines on Cleveland & Pittsburgh line running between Allegheny and Bellaire.

One for passenger engines on same line running between Wellsville and Cleveland.

One for freight engines on same line running between Allegheny and Bellaire.

One for freight engines on same line running between Wellsville and Cleveland.

The annual premiums will correspond with the monthly, and be determined by the same division of power, except that on the Cleveland & Pittsburgh line a second annual premium on each division will be paid to freight engines.

No engineer or fireman violating rules and neglecting duty will be entitled to premium for the month in which such misconduct occurs. In such cases the premium will be paid to the man showing the next best results.

Any engineer or fireman detected in fraud in anything pertaining to the stores, fuel or anything else, in any shape or form affecting the premium, will be discharged from the service, and debarred from future employment on the lines operated by this company.

J. D. LAYNG,
General Manager.

Tests of Metallic Alloys.

The "Committee on Alloys," consisting of R. H. Thurston, L. A. Beardslee, U. S. N., David Smith, U. S. N., of the United States Board appointed to test iron, steel and other metals, has issued the following circular:

Mechanical Laboratory, Department of Engineering, Stevens' Institute of Technology, Hoboken, N. J.:

SIR—A Committee of the Board appointed by the President of the United States, as provided by Act of Congress, approved March 3, 1875, has been instructed, during such time as may be found available pending the construction of the apparatus ordered by the Board for use in general work, and during such intervals as may subsequently be properly appropriated to such purpose, to investigate the mechanical, physical and chemical properties of the alloys of the useful metals, and to determine, if possible, their interdependence and the laws governing the phenomena of combination and of their resistance to stress.

The Committee desire to obtain records of all experiments which have hitherto been made in this direction, and to secure such exact information as may assist further researches. It is desirable that such records should embody a statement of the precise chemical construction of each alloy examined, as obtained both by synthesis and subsequent analysis. Its specific gravity, specific heat, conductivity, its combining number, and the relation of its chemical constitution to the series of similar compounds produced by alloying the elements in the proportions of chemical equivalents, should be stated whenever possible. A few thoroughly well studied examples will be of more service than a large number of isolated determinations of single facts.

It is further desired that the ultimate strength, the elastic limit, the modulus of elasticity, the ductility, resilience, homogeneousness, hardness and other mechanical properties of the specimen be ascertained and accurately stated.

Where only a part of this work can be done by the investigator, this Committee is prepared to assume charge of the remaining portion of the research, when the alloy can be furnished in proper quantity and form.

Reference to published accounts of similar works and monographs on any branch of the subject will be thankfully accepted. Special researches made for this Committee will be received with appropriate acknowledgments.

The departments of physic and of chemistry in the various colleges and universities will probably be able to render valuable aid, and their co-operation is earnestly requested.

The schools of engineering are in a position to assist this Committee very effectively and their contributions will be thankfully accepted.

Suitable blanks upon which to record the data offered will be furnished upon application.

Specimens of alloys for test by the Committee must be accompanied by a statement upon these blanks of their precise constitution, and such information as it is possible to give, with an account of such peculiarities as are known to distinguish the alloy, and of the special object which it is supposed may be attained by the investigation.

Where possible, it is required that one or more specimens shall be furnished of each of the specified kinds, and of precisely the form and dimensions, which will be given on application.

R. H. THURSTON, Chairman.

TRAFFIC AND EARNINGS.

Coal Movement.

Coal tonnages for the first six months of the year are reported by the lines given below. For the anthracite and Cumberland regions the period covered closes July 3, for the others June 28, the companies all reporting by weeks and not by months.

Anthracite:	1875.	1874.	Inc. or Dec.		P. c.
Delaware & Hudson Canal Co.	1,602,359	1,270,312	Inc.	332,047	26.1
Delaware, Lacka. & Western.	1,748,411	1,409,376	Inc.	338,035	24.0
Pennsylvania Coal Co.	644,478	618,252	Inc.	26,226	4.2
Central of New Jersey	309,135	1,228,129	Dec.	918,994	74.8
Lehigh Valley	623,900	2,091,712	Dec.	1,467,812	69.9
Pennsylvania & New York	56,714	33,626	Inc.	23,088	68.9
Philadelphia & Reading	864,877	2,417,269	Dec.	1,552,392	64.2
Northern Central and Summit Branch	548,760	398,388	Inc.	150,372	37.7
Dan., Hazleton & Wilkesbarre	32,576	13,009	Inc.	19,567	150.4
Totals	6,431,210	9,480,073	Dec.	3,048,863	32.2

The very large decrease on the lines serving the Schuylkill, Lehigh and Wyoming regions, as well as the increase on the others, is sufficiently explained by the long and obstinate strike in those regions which cut off the production of coal there almost entirely, while the absence of that supply necessarily increased the demand for the Scranton and Lackawanna coals, the production of which was not affected by any strike.

Semi-bituminous:	1875.	1874.	Inc. or Dec.		P. c.
Huntingdon & Broad Top	111,078	120,708	Dec.	9,630	79.8
East Broad Top	23,247	....	Inc.	23,247	....
Bellefonte & Snow Shoe	36,184	33,726	Inc.	2,458	7.3
Tyrone & Clearfield	402,688	298,068	Inc.	104,620	35.1
Cumberland, all lines	1,069,652	1,109,580	Dec.	39,928	3.6
Totals	1,642,849	1,562,082	Inc.	80,767	5.2

The increased shipments of Clearfield coal are notable. This and the Broad-Top coal are becoming serious rivals of the Cumberland. The East Broad-Top road was only partly completed last year, and reported no shipments.

Bituminous:	1875.	1874.	Inc. or Dec.		P. c.
Allegheny region	123,707	115,950	Inc..	7,757	6.7
Pittsburgh "	297,022	....		....	....
Westmoreland gas coal	247,641	443,280	Dec..	195,639	44.1
Barclay	30,087	....		....	....
Chesapeake & Ohio	80,325	....		....	....
Total	778,782	....		....	....

The decrease in Westmoreland gas coal was largely due to a prolonged strike among the miners.

Coke:	1875.
Tyrone & Clearfield	273
Pennsylvania R. R., Western Pennsylvania	63,247
Western Pennsylvania R. R.	25,097
Southwestern Pennsylvania R. R., Connellsville region	255,540
Total	344,157

The coal tonnage of the Belvidere Delaware Railroad for the six months was: 1875, 21,364; 1874, 485,459; decrease, 464,095 tons, or 95.6 per cent. This again was a result of the strike, most of the coal passing over this road coming from the Lehigh region.

The Chesapeake & Ohio Canal report for the month of June is as follows:

	1875.	1874.	Increase.	P. c.
Tons coal carried	145,736	118,175	27,561	23.3
Boats cleared	1,297	1,042	255	24.5

This was the greatest tonnage ever passed through the canal in one month.

Flour and Grain Movement.

Receipts and shipments have been reported as follows, flour in barrels and grain in bushels,

WEEK ENDING JULY 3.

Flour:	1875.	1874.	Inc. or Dec.		P. c.
Lake ports' receipts	84,021	85,498	Dec..	1,477	1.7
" " shipments	93,361	87,990	Inc..	5,371	6.1
Atlantic ports' receipts	189,653	158,858	Inc..	30,795	19.4
Grain of all kinds.					
Lake ports' receipts	2,637,540	4,437,625	Dec..	1,800,085	40.7
" " shipments	3,350,690	3,307,404	Inc..	43,286	1.4
Atlantic ports' receipts	2,645,876	3,965,793	Dec..	1,319,917	32.5

JANUARY 1 TO JULY 3.

Flour:	1875.	1874.	Inc. or Dec.		P. c.
Lake ports' receipts	2,282,940	3,199,432	Dec..	916,492	28.6
" " shipments	2,401,809	2,946,824	Dec..	545,015	18.5
Atlantic ports' receipts	4,499,115	5,380,036	Dec..	880,921	16.4
Wheat:					
Lake ports' receipts	22,929,416	38,054,518	Dec.	15,125,102	39.8
" " shipments	19,021,890	30,180,444	Dec.	11,158,554	37.0
Atlantic ports' receipts	17,711,670	31,430,509	Dec.	13,718,839	45.0
Corn.					
Lake ports' receipts	22,515,009	31,309,456	Dec..	8,794,447	28.1
" " shipments	16,061,752	20,679,454	Dec..	4,617,702	22.3
Atlantic ports' receipts	25,792,542	26,200,672	Dec..	408,130	15.6
Grain of all kinds:					
Lake ports' receipts	58,076,971	85,287,787	Dec..	27,210,816	31.9
" " shipments	43,948,745	62,488,937	Dec..	18,540,192	29.7
Atlantic ports' receipts	52,380,434	67,627,697	Dec..	15,247,263	22.5

CROP YEAR—AUGUST TO JULY 3.

The figures below are for receipts at northwestern ports for four years:

	1874–5.	1873–4.	1872–3.	1871–2.
Flour, bbls	4,936,920	5,868,590	5,403,810	4,846,122
Wheat, bush	57,454,152	79,389,493	49,922,530	38,175,491
Corn, "	41,178,815	57,947,092	55,396,747	63,168,575
Oats, "	21,347,282	25,371,647	26,589,009	27,948,401
Barley, "	5,723,973	6,948,506	9,099,588	6,309,315
Rye, "	1,144,810	1,710,480	1,829,886	2,717,788
Total grain, bush	126,849,032	171,367,218	142,838,360	138,319,570

This shows in comparison with last year a decrease in every grain, amounting to 16 per cent. in flour, 27.6 per cent. in wheat, 29 per cent. in corn, and 25.7 per cent. in grain of all kinds. In comparison with 1872–73, the decrease is less than 9 per cent. in flour, and 11½ per cent. in grain of all kinds; and in comparison with 1871–72, there is an increase of nearly 2 per cent. in flour, while the decrease in grain is only about 8 per cent.

Of the grain shipments from lake ports for the week ending July 3 about 31 per cent. went by rail this year, against 21 per cent. in 1874, and 33 per cent. in 1873. Of the shipments from Buffalo for the same week 18 per cent. went by rail.

Seaboard receipts of grain for the calendar year, though 22½ per cent. less than for the same time last year, have been 13 per cent. greater than in 1873, and not 4 per cent. less than in 1872.

Chicago receipts for the week ending July 10 were 36,266 barrels of flour and 1,023,285 bushels of grain of all kinds this year against 31,661 barrels of flour and 2,153,587 bushels of grain for the corresponding week in 1874, an increase of 15 per cent. in flour and a decrease of 55 per cent. in grain. The shipments were 36,179 barrels of flour and 1,733,477 bushels of grain this year against 33,422 barrels of flour and 2,505,222 bushels of grain last year, an increase of 8 per cent. in flour and a decrease of 31 per cent. in grain.

Petroleum Movement.

The receipts of crude at Pittsburgh from Jan. 1 to July 3 were 478,612 barrels this year, against 924,442 in 1874, 942,107 in 1873, 542,148 in 1872, and 528,441 in 1871, being thus little more than half of last year's receipts and smaller than for any other of the five years. The shipments of refined from Pittsburgh, 275,040 barrels this year, and 454,987 last. The diversion made to Baltimore is shown by the following statement of quantities shipped by each route:

	1874.	1875.
Pennsylvania Railroad	58,902 bbls.	1,053
Allegheny Valley	396,087 "	93,988
Pittsburgh & Connellsville	....	179,999

Last year the Baltimore road seems to have carried none; this year it has taken nearly two-thirds of the whole.

Railroad Earnings.

Earnings have been reported by the following companies:

Five months ending May 31:	1875.	1874.	Inc. or Dec.		P. c.
Union Pacific	$4,483,240	$3,660,751	Inc..	$822,489	22.5
Expenses	1,878,091	2,013,684	Dec..	135,593	6.7
Net earnings	$2,605,149	$1,647,067	Inc..	$958,082	58.2
Earnings per mile	4,344	3,546	Inc..	798	22.5
Per cent. of expenses	41.89	55.49	Dec..	13.60	24.5
Month of May:					
Atchison, Topeka & Santa Fe	$107,645	$101,344	Inc..	$6,301	6.2
Expenses	49,924	45,713	Inc..	4,211	9.2
Net earnings	$57,721	$55,631	Inc..	$2,090	3.8
Earnings per mile	212	199	Inc..	13	6.2
Per cent. of expenses	46.38	45.11	Inc..	1.27	2.8
Cairo & St. Louis	$28,109	......		....	....
Expenses	21,880	......		....	....
Net earnings	$6,229	......		....	....
Earnings per mile	192	......		....	....
Per cent. of expenses	77.84	......		....	....
Great Western of Canada	$347,000	$416,900	Dec..	$69,900	16.7
Expenses	325,600	358,400	Dec..	32,800	9.1
Net earnings	$21,400	$58,500	Dec..	$37,100	63.5
Month of June:					
Chesapeake & Ohio Canal	$82,396	$75,188	Inc..	$7,208	9.6
Expenses	25,133	......		....	....
Net earnings	$57,263	......		....	....
Cairo & St. Louis	25,653	......		....	....
Central Pacific	1,711,000	1,366,614	Inc..	344,386	25.2
Denver & Rio Grande	35,329	39,291	Dec..	3,962	10.1
Illinois Central	599,928	692,416	Dec..	92,488	11.9
Kansas Pacific	275,665	316,339	Dec..	40,674	12.8
Keokuk & Des Moines	66,488	49,954	Inc..	16,534	33.1
Missouri, Kansas & Texas	218,094	237,420	Dec..	19,326	8.1
St. Louis, Alt. & Terre Haute Main Line	71,697	99,844	Dec..	28,147	28.2
Branches	35,619	43,153	Dec..	7,534	12.8
St. Louis, Iron Mt. & So.	275,300	238,608	Inc..	36,692	15.4
Union Pacific	930,000	902,881	Inc..	27,119	3.0
Week ending June 25:					
Great Western	£14,149	£18,392	Dec..	£4,243	23.1
Week ending June 26:					
Grand Trunk	£33,000	£39,700	Dec..	£6,700	16.9

PERSONAL.

—From the funeral sermon of Mr. Eldridge Peirce, late Master Mechanic in charge of the Dennison shops of the Pittsburgh, Cincinnati & St. Louis road, which was preached in the Railway Chapel at Dennison, July 2, by Rev. C. J. Hunter, we take the following sketch of his life: "Eldridge Peirce was born in Dover, N. H., February 18, 1827, and died in Dennison, O., June 30, 1875. Mr. Peirce learned the trade of machinist in Lowell, Mass., and after completing his apprenticeship spent 15 years as a locomotive engineer, running upon almost every prominent Eastern road.

"In 1857 he came West, taking charge of the Central Ohio shops at Columbus, O. Soon after he was made Master Mechanic of the Cincinnati & Muskingum Valley Railroad, which he held two years. He then returned East, going back to his former occupation as an engineer, which he followed for five years longer, making in all 20 years of actual service upon the road. In 1864 he was invited and took charge of the Cleveland & Pittsburgh shops located at Wellsville, O., which position he held some eight years, until he came to Dennison, February 12, 1872."

—Mr. W. C. Cleland, General Western Passenger Agent of the Pennsylvania Company, has been granted a furlough and relieved from all official duty on account of his prolonged illness. All communications for his department must be addressed to Mr. F. R. Meyers, General Passenger and Ticket Agent, at Chicago, until further notice.

—Mr. J. W. Sencerbox, of Scott County, has been nominated by the Opposition Convention in Minnesota for the office of Railroad Commissioner.

THE SCRAP HEAP.

Railroad Manufactures.

Messrs. Sax, Kear & Co., of Pittston, Pa., inform us that the Pittsburgh Steel Casting Company is not making steel-tired car-wheels under their patent, as was stated recently. That company has merely executed orders for a number of tires to be used in the manufacture of the wheels, and has not made any finished wheels.

Much has been said of the great 50-ton steam hammer built for the Krupp works. One is now being constructed for the great French works at Creusot which will throw the Krupp hammer into the shade. It will weigh 60 tons, and have a net fall of 13 ft. 2 in.; while the Krupp hammer weighs 50 tons and has a fall of a little less than 6 ft. 8 in. The Creusot hammer will give a blow about 2½ times as powerful as that of the Krupp hammer. It is intended for forging large masses of steel. The cost is estimated at about $400,000.

Messrs. F. L. Pope & Co.'s transfer of their telegraph supply business to L. G. Tillotson & Co. does not include the business of the Electric Railway Signal Company, which has been established and conducted by the members of the firm of F. L. Pope & Co. The Signal Company remains under its original management.

New System of Tracing Baggage.

An exchange says: "The Delaware & Hudson Canal Company has inaugurated a new system of checking baggage, by which a register is taken of every piece of baggage as it is placed in the company's cars, by means of a manifold making two records at once. One record is kept by the baggageman at the station, and a receipt taken for the baggage from the train baggageman, who keeps the remaining copy of the record and compares it with the numbers of the checks."

Prizes to Enginemen.

The Fort Wayne *News* of July 1, says: "It has been the custom of late of the Pittsburgh, Fort Wayne & Chicago Railroad authorities to pay a premium of $20 per month to the engineers who exercise the greatest economy during that time. Yesterday we made note of the fact that Gordon Simmons had received the premium, but it appears that there are more than one premium. Below we give the list as posted up in the Pittsburgh round house: On through passenger, engine No. 223, 1 383-1000 cents per car hauled one mile; Charles Miles. On local passenger, No. 122, 2 244-1000 cents per car hauled one mile; Gordon Simmons. On standard freight, first premium, engine No. 212, 463-1000 cents loaded car hauled one mile; Oliver Hebart. On standard freight, second premium, engine No. 204, 466-1000 cents loaded car hauled one mile; George Kover.

"Other engines rated as one class, engine No. 184, 717-1000 cents loaded car hauled one mile, name unknown, being on west end of line between Valparaiso and Chicago."

"Cutting Down Expenses."

The experience of some of our railroad officers in the practice of this disagreeable art has been great since the panic, and has taught them more than they ever knew before of the amount of work it is possible for one man to do. One railroad officer, who has two or three times had to execute an order to "cut off every man not absolutely necessary," said recently: "I went over the road and discharged every man whom I thought we could spare, and then I went over it again. At first where there were three men I cut down the number to two, and then I reduced the force to one; and now I am looking out for some one-armed men, so that I may put half a man in the place of one."

A Novel Celebration.

At the recent celebration of the Battle of Bunker Hill, in Boston, the National Tube Works Company was represented by some specimens of lap-welded wrought-iron tubing on a wagon tastefully draped with bunting. The tubing, some of the specimens of which were very large, was effectively arranged to represent a cannon on a gun-carriage. The carriage was made of tubing, six sections on a side, the cannon being represented by a section of lap-welded tubing twelve inches in diameter, said to be the largest manufactured in the world. On each of the tubes of which the carriage is composed was the name of one of the original thirteen States, and on the large tube, representing the "big gun," was inscribed—"Massachusetts, 1775—Our Union Welded—1875."

RAILROAD GAZETTE

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CONTENTS.

Editorial Announcements.

Addresses.—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CAR WHEEL MILEAGE.

On another page we give a report of the discussion at the late Convention of the Master Car-Builders' Association on the above subject. We also publish a letter from a correspondent in reply to an editorial which appeared some months ago under the title: "Does it Pay to Keep Car Mileage?" The letter referred to supplies some much needed information concerning the cost of keeping car mileage. It should be observed, however, that the cost given is for the cars employed in passenger service alone. It will, however, probably furnish the requisite data from which an approximate estimate can be made of the cost of keeping car mileage. That is, if it costs $433 per year to keep the mileage of 301 cars, the cost per car per year would be $1.43 per year. At this rate, it would cost the Lake Shore Railroad, which has an equipment of a little over 10,000 cars of all classes, about $14,300 per year to keep the mileage of all its cars. Probably the expense of keeping such an account would soon be reduced after it was once put into practical operation, so that the cost would not exceed one dollar per car per year. Considering the fact that it will be impossible to reduce railroad operations to anything approximating an exact science until the mileage of cars is known, it would seem that the information thus gained would be worth the expense of keeping an account of the mileage of cars.

Objection is frequently made to keeping car mileage, on the ground that it is impossible to know how far cars run when they are used on foreign roads. As all roads exact some pay for the use of their cars on other lines, it is important that some accurate account should be kept of their mileage while away from home. Even if no account is kept, and the mileage is merely estimated or guessed at, such estimates would afford the data from which the mileage on foreign roads could be made up, and would be approximately correct.

That the importance of keeping car mileage is beginning to be appreciated is indicated by a blank locomotive report which we have before us from the Chicago, Burlington & Quincy Railroad, in which, besides the ordinary information, there is a heading for "car mileage," and another for "cost per train mile," under which the cost for "engine service, repairs, fuel, oil, waste and tallow," are each given separately. Below these is a heading in which the whole cost is reduced to that "per car per mile," and the fuel consumed is reduced to the same standard. With this information, and the average amount of freight and number of passengers carried per car, it will, of course, be easy to calculate the cost of locomotive service per ton of freight and per passenger per mile.

We have also been informed, that several car-wheel manufacturers, since railroad companies have given closer attention to the service performed by car wheels and have kept such accounts as would enable them to arrive at approximately correct results, have reduced the amount of mileage which they guarantee their wheels to make from 50,000 to 45,000, thus showing that through sheer ignorance of the service performed by the wheels they bought some railroad companies have been paying for ten per cent. more service than the wheels were capable of rendering. Doubtless the actual facts, could they be known, would show much *more* unfavorably than the above for the purchasers of wheels.

There is, however, some danger, when persons first begin keeping accounts of wheel mileage, that they will draw unwarrantable inferences from the first reports. Thus the wheels which fail first will of course show the smallest mileage, and the average amount of service rendered will increase until the last wheel, or the one which will give the greatest service, is worn out. To illustrate this, we will take a very simple case, that of 12 wheels put under a car January 1. We will suppose that one wheel fails each month, and that the total mileage is that given in the third column of the table below, and the average mileage of all the failed wheels that given in the fourth column. If the mileage of the first wheel is 1,000 miles, and that of the second 10,000, the average for the two will of course be 5,500. If the third wheel runs 19,000 miles the average of the three will be 10,000 miles. As the wheels which run the farthest fail last, it is clear that the average milage of any lot of wheels will continue to increase until the last one is worn out,

	No. of wheels which failed.	Distance run by wheels which failed.	Average distance run by all the wheels which failed.
January	1	1,000 miles	1,000 miles
February	1	10,000 "	5,500 "
March	1	19,000 "	10,000 "
April	1	28,000 "	14,500 "
May	1	37,000 "	19,000 "
June	1	46,000 "	23,500 "
July	1	55,000 "	28,000 "
August	1	64,000 "	32,500 "
September	1	73,000 "	37,000 "
October	1	82,000 "	40,500 "
November	1	91,000 "	46,000 "
December	1	100,000 "	50,500 "

and that if we take the average before those which perform the maximum service fail, it will indicate very erroneously what the *average* performance of *all* the wheels will be. Of course, so simple a case as that shown by our illustration very rarely or never occurs in practice. On a railroad, when one wheel wears out another is substituted, so that it would be difficult to get an accurate history of any given number of wheels put in at one time. What we wish to call attention to here is, that it is impossible to get a correct average of the service performed by wheels until the accounts have been kept long enough to get the mileage of those which perform the maximum amount of service. If, therefore, we estimate the endurance of the wheels manufactured by any maker by the results shown by an account kept for a very short time, there is danger that we may do very great injustice to such makers. There will be among the wheels made by the most reliable manufacturers some with defects that the most rigid inspection will not detect. These, of course, fail first. If it is desirable to make a comparison of the endurance of wheels before the accounts are kept long enough to tell what the total average will be, it might be done by learning the total number of each kind in use, and the number which have failed, and reducing the average service performed by those which have failed to percentages of the whole number in use. Thus we might compare the service of ten per cent. of the wheels made by one manufacturer with that of 10 per cent. of those made by another, being sure, however, that the number in use was large enough to give an approximately correct average. It would, therefore, we believe, always add to our information if the total number of wheels of each kind put into service is given. It will then be an easy matter to represent graphically, by curves, the performance of each kind of wheels in percentages of the whole number in use.

The methods of keeping the accounts of wheel service differ very much on various roads, and probably only longer experience will develop the best and simplest methods of doing this. We have received from different roads copies of the blanks used for keeping car and wheel mileage, all of which differ from each other in their arrangement, and in the headings under which the information is to be gathered. It should be added that, so far as we know, there is no road which keeps any account of wheel mileage, excepting on passenger equipment, and that the service under freight cars is deduced almost entirely from the time during which the wheels are in use. Of course such an estimate has no claims to accuracy, and the deductions therefrom are only an approximation, and that a very doubtful one, to the actual facts involved. At the present time, for example, when most roads have many cars not in use, wheels may be idle for weeks at a time, and therefore when the account of their service is made up, if it is estimated by time alone, it will show a much greater service than was actually performed. When roads are crowded with traffic the very reverse condition of things might and probably would exist.

It will be seen from the report of the Master Car-Builders' Convention, that the relative advantages of steel and iron wheels was discussed with a good deal of animation. It is, we believe, quite certain that steel wheels will compete with cast-iron wheels in the future. Which will ultimately prove to be the cheaper is, we think, not yet demonstrated satisfactorily, and it is only by keeping such accurate accounts as are now kept on the Boston & Albany Railroad that it will be possible to know which kind of wheel will be the most economical.

On another page we give an illustration of a cast-iron wheel with steel tire, which is used quite extensively on the Baltimore & Ohio Railroad for engine trucks. The engraving shows clearly how these tires are put on—certainly a more convenient way than the ordinary method of shrinking them on. Unfortunately, no accounts are kept of the mileage of these or any other wheels on the Baltimore & Ohio road, so that it is impossible to compare the service of these with that of ordinary cast-iron wheels. It is such problems as these which indicate the importance of keeping accounts of car and wheel mileage, and until this is carefully done it will be impossible to formulate the business of transportation by railroad into a science. Much more advantage to the public and to the owners of railroads can be anticipated from such information than from brilliant inventions or the exercise of mere spontaneous ingenuity without the aid of the information which only experience can teach, and which can only be learned by carefully recording the lessons it inculcates.

AMERICAN COAL PRODUCTION.

There is no substance forming a staple of general consumption and carried considerable distances by rail which is so heavy in proportion to its value as coal. This is but another way of saying that, in places at all distant from the mines, transportation must necessarily form a large part of the value of this fuel, and that, as it is indispensable for daily life as well as for the most important manufactures, coal affords one of the principal staples of transportation. We are accustomed to hear of the effect of transportation charges in checking the movement of grain and its production in the frontier States; but a ton of corn, at the lowest price known of late years, brings more than twenty dollars in New York, while a ton of coal is counted very costly almost anywhere in the country if the price reaches ten dollars.

The fact is that fuel is not only a necessary of life, but it is necessary that it should be cheap; otherwise a country will hardly be inhabited. Consequently, coal is usually carried moderate distances from the mine, unless there is some very cheap water route open for it; and a railroad traffic in coal is for the most part a local traffic, of infinite importance, perhaps, to a certain territory, but not of importance to the country at large, when considered separately, nor to the railroad system as a whole. This probably leads us to neglect the importance of coal transportation in the aggregate—certainly one of the leading branches of transportation on American railroads.

The peculiar position of the anthracite mines, confined to a small territory but enormously productive, and furnishing the chief fuel to the towns and cities as far east as Maine and as far west as Baltimore and Buffalo, and a great deal of domestic fuel to Northwestern and Canadian towns—the peculiar position of these mines has drawn attention to the importance of anthracite traffic, on which the most populous part of the country chiefly depends. The traffic, at its origin, is concentrated upon comparatively few routes, and accurate statistics of it have been preserved for many years. So far as weight is concerned, no staple transported in the United States, except bituminous coal, can compare with it. All the grain marketed in the country has but a fraction of the weight. In 1874 the Pennsylvania anthracite moved was more than 24,000,000 tons. For the same year the grain receipts at the Northwestern ports, or those at the Atlantic seaboard, were not one-third as heavy, and the estimates of the total crop raised in the United States for 1872 makes less than 43,000,000 tons, four-fifths of which was corn and oats, mostly consumed on the farms where they were raised. Grain, indeed, would be comparatively an unimportant traffic staple but for the distances over which it is moved—often 1,500 miles by rail and then 3,000 miles by sea, while the largest wheat exports of the United States go several times as far by sea, from San Francisco to Liverpool.

But anthracite coal is confined to a little district in Eastern Pennsylvania, while bituminous coal is mined and consumed in two-thirds of the States of the Union, from Pennsylvania to California, and from Michigan to Alabama. The districts producing bituminous coal are usually much less productive than the anthracite districts, and their product, in great part, is used chiefly for domestic consumption within a hundred miles of the mines. Thus not only is their aggregate importance likely to be

underestimated or quite neglected, but records of their product and its distribution either are not preserved or are not collected, so that it is next to impossible to say what has been the yearly product of bituminous coal in the United States. Mr. Richard P. Rothwell, Editor of the *Engineering and Mining Journal*, in a paper read at the New Haven meeting of the Institute of Mining Engineers, has attempted to collect statistics of the product of 1874, both in anthracite and bituminous, and, though in the latter there must be many inaccuracies, this is yet doubtless the most complete statement ever made, its errors probably being chiefly omissions.

Mr. Rothwell's paper gives the production by States. The aggregates are, in tons of 2,000 lbs:

Anthracite	24,231,471 tons.
Bituminous	25,248,684 "
Lignite	1,217,020 "
Total	50,747,175 "

With the exception of 14,000 tons from Rhode Island, the anthracite is all from Pennsylvania; the lignite is from the territories of Wyoming, Colorado, Utah, Washington, and the States of Oregon and California, and includes their total production.

Here we find a weight of material greater by a sixth than the total grain production of 1872, (we have not the figures from later years), while, as we have said, most of the grain is never moved from the farms on which it is raised, being there consumed by cattle; while nearly every ton of coal requires transportation of some kind to move it from the mine to the consumer, and most of that transportation is supplied by railroads and vessels of various kinds. It is safe to conclude that several times as many cars are loaded with coal in this country as with any other one product.

Mr. Rothwell's figures show that Pennsylvania is the largest producer of bituminous as well as of anthracite coal. The amount is given as 12,280,144 tons, which is nearly half of the total bituminous production reported. Ohio follows, with 4,168,445 tons; Maryland is third, with 2,700,000 tons, and Illinois fourth, with 2,577,095 tons, no other State producing so much as a million tons. Probably the Pennsylvania and Maryland returns are more complete than those of the more Western States, where many of the mines are new, and the traffic in the product isolated and little known.

Notwithstanding the enormous quantity of coal product reported, the wonder is that it is not greater. Fifty millions of tons is a great deal, doubtless; but then the population of the United States in 1874 was probably not less than 43,000,000, so that there was but a ton and a sixth of coal per inhabitant—certainly not a large supply.

It would be an entirely insufficient supply if the chief fuel of the rural districts in most parts of the United States was not still wood. This is true even of a large part, probably the largest part, of the prairie country. There has been a great change in this respect within ten or fifteen years, it is true, and the use of coal among the farmers of Illinois, Iowa, Missouri and Kansas is extending, but still it will be found that wood continues to be the fuel of a large part—probably most—of the farmers and of some of the town people within fifty or sixty miles of the Illinois coal mines, even where there is good rail connection. This is really what was to be expected. The skirting of woodland along the streams in the prairie country, though affording very little timber, has perhaps as much firewood as when the country was first settled; it is near the farmers, and if not used as fuel by them would scarcely have any value. The effect of opening coal mines and railroads, therefore, has been rather to cheapen wood than to prevent its consumption.

Nevertheless, a great increase in the domestic consumption of coal throughout the country is to be looked for. For however long the farmers may use wood, the towns already use coal chiefly, and the growth of population in the towns is much faster than in the country. Moreover, while the increase of the population must use coal chiefly for fuel, it will also require an unusually large proportion of fuel per inhabitant. For the additions to the population will be largely engaged in manufactures, and will require a large amount of fuel in their industries as well as for domestic purposes. Indeed, this change in the industries of the nation, which already has made great progress, needs to be recognized more generally than it has been, or many business calculations having regard to the future are likely to miscarry. Railroad companies, unless their lines are in unsettled or half settled States, should keep in mind that the increase in their traffic will come hereafter in a larger and larger proportion from manufactures. The agricultural traffic will grow, but the other traffic will grow faster.

Not only does coal form a large and indispensable element in this other traffic, but its abundant and cheap supply is indispensable to the creation of a large proportion of all the rest of it. The railroad companies are therefore only less interested than the coal-owners themselves in the opening and economical working of the mines and the cheap transportation of their product. This is especially true in those districts where manufactures are springing up. Possibly the present population will have to depend wholly upon one fuel and one railroad for its supply, and both miners and carriers can be sure of a large profit on the existing coal business. But, though a considerable difference in the cost of the coal, whether caused by charges of the miner or the carrier, may have a slight effect on domestic consumption, it may easily decide the question of the future growth of the towns on the line. That growth must come chiefly from new manufactures, and the manufacturers, having a choice of lines and locations, will often be compelled to select that place where their expenses will not be increased by high charges for fuel.

There are some industries, doubtless, for which railroads could well afford to carry their coal, even when forming a very large traffic, for bare cost, rather than have them established on other lines. The three or four thousand people brought together by the great manufactory will probably afford a greater and a much more profitable traffic than all that of the manufactory itself.

This country is favored with the most extensive coal fields in the world, a large part of which we have just begun to work. The growth of the country and the nature of that growth render it probable that the coal-mining industry will increase much faster than the average increase of the national industries; and its growth must inevitably add greatly to the traffic of the railroads, which, on the other hand, can do much to hasten the development of this industry, and with it very many other important industries which require a cheap and abundant supply of coal.

Awarding Contracts Unfairly.

We hear a good deal of complaint from various contractors, but especially bridge-builders, about the manner in which contracts for work are often awarded. Parties having such work to be done will ask for bids. It might, and justly so, be expected that when those bids are received the persons or company offering the best terms—that is, the lowest prices or the best work, or the two combined in the most advantageous proportions, would get the work. Unfortunately this is rarely certain to be the case. On the contrary, it very often happens that some favorite is either supplied with information secretly, which will enable him to make the terms of his offer conform to those of some competitor, or else the lowest or most favorable offer is used simply as the standard of price to which the favored contractor must conform. Now to fair competition no right-minded business man will object, but it is a great injustice to induce men to spend time and labor in preparing plans and estimates, with the expectation that they will be dealt with fairly, whereas the secret intention is entertained all the time of awarding the contract to some favorite who for some reason, to use a slang phrase, "is inside the ring," whatever the character of that ring may be.

How many contractors, for example, would be likely to present tenders for a contract if the facts as they often exist were accurately stated? Suppose, for example, that an advertisement were to appear in, say the *Railroad Gazette*, similar to the following:

"The General Manager of the Bow String Railroad is prepared to receive tenders for the construction of a bridge across the Tangent River. The following are the specifications to which the structure must conform: * * * *

* * * * * * * * * * * *

"Mr. T. O. P. Chord, C. E., being a relative of two of the directors of the said railroad, and having agreed to bribe certain other directors by purchasing the material for the bridge of them, the contract will be awarded to him if, after the tenders have been opened and their contents made known, he will conform to the most favorable terms offered by other contractors."

On such conditions how many engineers would spend either time or trouble in estimating for the work? Nevertheless, the conditions stated are exactly similar to those which often actually exist, but are kept secret. When such is the case, the parties concerned are inducing contractors to expend time and labor under false pretences, which, although not an actionable offense under the law, is nevertheless a great injustice, and is morally as much of a theft as procuring money in a similar way would be.

So common is it to award contracts in this way that some of the most trustworthy engineers will not bid for work until they have first made inquiry whether the award will be made justly. It is, of course, impossible in the great majority of cases to learn whether such is the case or not, and therefore contractors are compelled to do an immense amount of work which is absolutely useless, and if the existing conditions which controlled the award had been known, would never have been done.

It is not alone the contractors who suffer from such a condition of things. The effect upon the interests of a company is the same as that of all bribery, which is to bias the minds and warp the action of those who ought to be able to act perfectly disinterestedly. If A, B, C and D must gain some profit from a contract, an engineer or manager of the affairs of a company is no longer able to make the interests of the stockholders his chief and only aim, but is obliged to shut his eyes, so that A and B may sell their iron or C and D be sure of a commission for their "influence" in securing the contract for their friend. It is such means as these that lead to and result in legalized thievery and have converted so many corporations into organized bands for the robbery of those who have entrusted their money to their care.

Record of New Railroad Construction.

This number of the *Railroad Gazette* has information of the laying of track on new lines as follows:

Rome, Watertown & Ogdensburgh.—The *Lake Ontario Division* has been extended from Charlotte, N. Y., westward 9 miles.

Southern Pacific.—The *Los Angeles Division* has been extended southeastward 16 miles to a point 56 miles from Los Angeles.

This is a total of 25 miles of new road, making 426 miles completed in the United States in 1875, against 690 miles reported for the same period in 1874, and 1,518 miles in 1873.

THE RAILROAD WAR continues about as it was a month ago. There seems to be no nearer approach to a settlement of rates, which remain for passengers $15 from Chicago to New York, and $18 from New York to Chicago. The northern lines to Chicago and the lines from Chicago to St. Louis object to making the rates to St. Louis so nearly like those to Chicago as the Pennsylvania and the Baltimore & Ohio had agreed upon. When the rate from New York to Chicago was $22, the rate to St. Louis was usually $27 or $29. By the recent agreement it was to be only two dollars more than the Chicago rate. By the shortest routes the distance is 1,063 miles to St. Louis against 911 to Chicago, the St. Louis line being thus one-sixth longer than the Chicago line. By way of Chicago the shortest line from New York to Louis is 1,190 miles, but so many travellers wish to visit both towns that a considerable part of the St. Louis business is done by way of Chicago. It is not to the advantage of the Pennsylvania and the Baltimore & Ohio to cultivate this business, however, as they have the short lines by way of Indianapolis and Cincinnati, and would secure a larger proportion of the traffic for these lines if the rate by Chicago was higher. There cannot be much profit on the business done by way of Chicago, but the Chicago railroads cling to it; and, indeed, it is probable that Chicago business is actually done at less cost per mile than St. Louis business, on account of the much greater bulk of travel and average size of trains to and from Chicago; so that there may be some reason in the claim that the rate to St. Louis should be more per mile than to Chicago. We shrewdly suspect, however, that some of the railroad companies have lost money on the passengers they have taken to and from St. Louis by way of Chicago, and it is hardly to be expected that the Pennsylvania should willingly accept $27, or any other rate, for a trip 1,190 miles long, when it can get the same sum for carrying the passenger between the same points by a route 130 miles shorter. By the old system it offered a premium (by giving the privilege of going by way of Chicago) to those travelers who chose to take the route costing the company the most. To be sure, the other practice of charging in proportion to distance would tend to divert traffic to its lines from the northern routes, to which, doubtless, it is not at all averse. The whole matter is one calling for compromises, as the value of a traffic may be less important than the establishment of harmony.

THE GRAIN CROP, on which the prosperity of the railroads and the country depends to a large extent, promises to be generally very good—probably quite as good as last year—except on the Pacific coast, where the surplus for export is expected to be a third less than last year. Kansas and Nebraska, except in the narrow strip near the Missouri which was ravaged by grasshoppers, are reported to have enormous crops of wheat. It is also evident that the European crop will be much lighter than last year. The floods in France and Hungary have had an unfavorable influence, and the Russian crops are reported to be inferior. It is too early to decide as to the crop in Great Britain, but it is less promising than at this time last year. The decrease in the California crop will have quite as much effect as a similar decrease in the European crop in promoting a demand for grain shipped by way of our Atlantic ports. California, apparently, will export about 6,000,000 bushels less than last year. As there is a large surplus of last year's crop on hand, both in Europe and America, very high prices are not to be looked for; but it seems reasonable to expect such an improvement in the demand as will make an active movement in American breadstuffs, which will be of great influence on all the business interests of the country, and first of all on transportation.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

Gilman, Clinton & Springfield.—In spite of the election held by some of the county and private stockholders recently, an adjourned meeting of the stockholders adhering to the present board was held, July 8, and the following were elected directors to fill the places of those whose terms have expired: T. J. Carter, Springfield, Ill.; Clinton H. Moore, Clinton, Ill.; L. P. Morton, New York; Charles S. Seyton, London, England.

Ogdensburg & Lake Champlain.—At the annual meeting in Malone, N. Y., June 23, the following directors were chosen for the ensuing year: J. C. Pratt, G. M. Barnard, Francis Cox, Theo. A. Neal, J. D. Farnsworth, C. T. Hulburd, Wm. J. Averill, J. S. Farlow, Thomas Upham, E. T. Farrington, George Lewis, S. M. Felton, Albert Andrus.

Lake Michigan & Wabash River Ship Canal.—Mr. George Crocker, late Division Engineer of the Illinois Division of the Baltimore, Pittsburgh & Chicago road, has been appointed United States Assistant Civil Engineer in charge of the surveys for a ship canal from Lake Michigan to the Wabash River.

Kansas City, St. Joseph & Council Bluffs.—Mr. A. R. Storer has been appointed Paymaster and E. M. Ford Cashier, in place J. H. Goodspeed, resigned.

Cairo & Vincennes.—Messrs. Drexel & Tracy, the new receivers, have appointed Mr. H. T. Morrill, one of the late receivers, General Superintendent of the road.

Jeffersonville, Madison & Indianapolis.—Mr. John W. Vaughan has been appointed Master of Transportation, in place of Omer Rogers.

Louisville, New Albany & St. Louis.—Mr. W. B. Hamilton has been chosen a director in place of Mr. W. F. Barrett, resigned.

Chicago, Rockford & Northern.—Mr. Daniel B. Waterman is President of this new road, B. F. Lewis, Secretary, and R. P. Lane, T. D. Robertson and Gilbert Woodruff, trustees.

Indianapolis & St. Louis.—The Indianapolis *Journal* says:

"It is rumored in railroad circles that Samuel Woodward, General Superintendent, and J. C. Noyes, General Freight Agent, of the Indianapolis & St. Louis road, are about to tender their resignations, and that J. E. Gimperling, recently Superintendent of the Indianapolis, Bloomington & Western road, will fill the vacancy caused by the resignation of Mr. Woodward, and A. E. Shraeder, formerly General Freight Agent of the St. Louis & Southeastern road, takes the place of J. .C Noyes."

Boston & Lowell.—Mr. J. W. Whittaker, for many years Paymaster of this road and the Lowell & Nashua, has been appointed Auditor also.

Maine Telegraph Company.—At the annual meeting in Bangor Me., June 30, the following directors were chosen: Wm. Gallupe, Albert Holton, Albert W. Paine, Jacob A. Smith, Bangor, Me.; Edwin F. Littlefield, Winterport, Me.; Hiram O. Alden, Wm. H. Simpson, Belfast Me.; Bion Bradbury, Wm. P. Merrill, Portland, Me. The board elected Hiram O. Alden, President and W. P. Merrill, Secretary and Treasurer.

South Shore.—At the annual meeting in Boston, July 7, the following directors were chosen: Onslow Stearns, Oliver Ames, Uriel Crocker, Francis B. Hayes, Ephraim U. Winslow. Charles F. Choate was elected clerk of the corporation.

St. Louis, Kansas City & Northern.—Mr. H. A. Russell has been appointed General Agent at St. Joseph. Mo., in place of W. M. Merritt, removed. Mr. Russell has been chief clerk in the office of Mr. S. P. Brown, General Agent at Kansas City, and is said to be a capable and promising man.

Connecticut Railroad Commissioner.—The Governor of Connecticut has nominated Mr. Minnott A. Osborn, of New Haven, Railroad Commissioner, to fill the vacancy which occurs this year. The Senate has not yet confirmed the nomination, to which there appears to be some opposition.

Michigan Central.—Mr. T. B. Sargeant, Superintendent of the Bay City Division, has been appointed also Superintendent of the new Mackinaw Division, which includes all of the Jackson, Lansing & Saginaw road north of Wenona. His office will be at Bay City, Mich.

Lehigh Valley.—Mr. H. E. Packer has been appointed Superintendent of the New Jersey Division, which consists of the new Easton & Amboy road. His office is at Bound Brook, N. J.

Louisville, Paducah & Southwestern.—Mr. B. Du Pont, President of the company, has been appointed Receiver. He has reappointed all the officers of the road.

New York & Oswego Midland.—Mr. L. A. Lathrop has been appointed Cashier in place of T. C. Purdy. The office of Purchasing Agent has been abolished.

Port Royal.—Mr. D. C. Wilson, President of the company, has been appointed Receiver. He has appointed W. H. Johnson Treasurer.

Pennsylvania Company.—The current monthly reports of mileage of the following-described cars, viz.: Union Line, National Line, Allentown Line, Refrigerator Line, belonging to this company as proprietary owner thereof, should be forwarded to John T. Denniston, Auditor Union Line, Pittsburgh, Pa., instead of as heretofore, to D. S. Gray, Western Manager.

Lafayette, Muncie & Bloomington.—At the annual meeting in Lafayette, Ind., July 6, the following directors were chosen without opposition: J. E. Burson, David Crouse, James B. Falley, Frederic Geiger, W. H. Harris, Joseph Heath, John W. Heath, Joseph M. Hersley, O. W. Pierce, W. A. Potter, C. C. Richardson, David Slifder, E. C. White. The board elected John W. Heath President; James B. Fally, Vice-President; O. W. Pierce, Treasurer; Mr. Castator, Secretary.

North Brookfield Branch.—At the annual meeting, recently, the following directors were chosen: Charles Adams, Alden Bacheller, A. H. Bacheller, Theo. C. Bates, John B. Deming, John Hill, George C. Lincoln, Wm. H. Montague, Bonner Nye, Curtis Stoddart, Liberty Stone, Dr. Warren Tyler, Freeman Walker. The board elected A. H. Bacheller President; Bonner Nye, Alden Bacheller, Vice-Presidents; Theodore C. Bates, Secretary; Charles Adams, Treasurer.

New York & Long Island Bridge Company.—The new board has elected officers as follows: President, Wm. Steinway; Vice-President, A. M. Bliss; Secretary, R. M. C. Graham; Treasurer, Edward J. Woolsey; Executive Committee, John T. Conover, Paschal W. Turney, H. C. Poppenhusen, Willy Wallach, C. H. Rogers; Finance Committee, Abraham D. Ditmars, Oscar Zollikoffer; Auditing Committee, C. A. Trowbridge, Pliny Freeman.

Waukon & Mississippi.—The officers of this new company are: Dudley W. Adams, President; Martin Stone, Secretary; L. W. Hersey, Treasurer.

Erie.—At the annual meeting in New York, July 13, the following directors were chosen: Herman R. Baltzer, S. L. M. Barlow, R. Suydam Grant, Hugh J. Jewett, John Taylor Johnston, Louis H. Meyer, Edwin D. Morgan, Marshall O. Roberts, Samuel Sloan, Henry G. Stebbins, New York City; Homer Ramsdell, Newburg, N. Y.; Lucius Robinson, Elmira, N. Y.; Giles W. Hotchkiss, Binghamton, N. Y.; Solomon S. Guthrie, Buffalo, N. Y.; Cortland Parker, Newark, N. J.; Asa Packer, Mauch Chunk, Pa.; Thomas Dickson, Scranton, Pa. The new directors are Messrs. Sloan, Hotchkiss, Guthrie, Packer and Dickson, who replace Wm. Butler Duncan, John A. C. Gray, Frederick Schuchardt, Thomas A. Scott and John King, Jr., the last named gentleman having, however, resigned some months ago. Of the new directors, Mr. Hotchkiss has been in the board before; three of the others are presidents of other companies, Mr. Sloan, of the Delaware, Lackawanna & Western; Mr. Packer, of the Lehigh Valley, and Mr. Dickson, of the Delaware & Hudson Canal.

Missouri, Kansas & Texas.—Mr. A. B. Garner has been appointed General Superintendent. He has been for some time Superintendent of the Smoky Hill Division of the Kansas Pacific.

Detroit, Eel River & Illinois.—Mr. Jas. A. Hughston having resigned his position as General Ticket Agent, Mr. S. Howell will assume the duties of that office in connection with the general freight agency. All car service reports should be addressed to Mr. S. Howell. Settlements of all balances due, or remittances, should be made with Mr. S. D. Mason, Cashier. The offices are at Logansport, Ind.

OLD AND NEW ROADS.

New Haven & Northampton.

The long controversy between this company and the people of Plantsville, Conn., has been settled by a vote of the Legislature, which requires the company to stop its trains at Plantsville when the people there have built a depot. The quarrel is of several years duration and has been before three legislatures, including the present one.

Waukon & Mississippi.

This new road is to extend from Waukon, Ia., eastward to the Chicago, Dubuque & Minnesota, at Paint Creek, and is thus described by the Waukon *Standard:*

"The length of the Waukon & Mississippi Railroad is nearly 23 miles. The grade for the entire distance is 580 feet, leaving the river several feet above the water level, and not reaching the summit level entirely, being an average grade of 25 5-23 feet per mile. The heaviest grade is the last two miles, entering Waukon, in which distance the rise is 153 feet, or an average of 76 feet 6 inches per mile. As to bridges, four or five will be just about 100 feet span each, and except these no bridge will exceed 25 feet span, and but very few will exceed 15 or 16 feet."

It is to be of 3 feet gauge and to be built entirely with local capital.

New Jersey Midland.

The plan of reorganization proposed provides for the formation of a new company which shall issue securities as follows:

1. First-mortgage bonds to the amount of $800,000, to be used to pay off arrears of wages and loans; to pay rentals due and receiver's certificates; to buy new equipment and to complete the road to the Hudson River.

2. General-mortgage bonds to the amount of $4,500,000, of which $3,700,000 shall be exchanged for the present first-mortgage bonds and unpaid coupons, and $800,000 to exchange hereafter for the first-mortgage bonds provided for in Section 1. The company to have the option for five years of paying interest in scrip, convertible into 10-year income bonds.

3. First preferred 7 per cent. stock to be exchanged for the second-mortgage bonds and unpaid coupons.

4. Second preferred 7 per cent. stock to be exchanged for the consolidated bonds and unpaid coupons.

5. Common stock (not to exceed $1,400,000) to be exchanged for the present stock.

6. Holders of mortgage bonds to have one vote for each $100 until interest has been paid in cash for three years.

7. Parties receiving new stock to pay an assessment of $2 per $1,000, to meet expenses of reorganization.

The objections urged against this plan, and to an outsider they appear entirely reasonable, are, that it gives entire control of the property to the holders of the junior securities, whose votes would over-balance those of the bondholders; that it is entirely in the interest of those junior securities, and that is simply absurd to expect that the road can for many years, if ever, hope to earn interest on a bonded debt of over $60,000 per mile. A further objection is that the first-mortgage bondholders are asked to admit a new lien ahead of theirs, but that they would probably have to do in any case.

At the bondholders' meeting in New York, July 14, there was a large attendance. Mr. Wortendyke said that the Weehawken property had cost the company $450,000, of which $184,000 was yet unpaid. It included 40 acres and was worth $1,000,000. The first-mortgage bonds had sold well, averaging about 90. Some of the right of way was still in dispute. Mr. Hobart, one of the receivers, said that the liens ahead of the first mortgage were about $360,000; the total assets were $3,582,650, and the liabilities $8,000,000.

Mr. McCullagh, the other receiver, said the receipts for four months past had been in excess of the expenses. The road was in a fair way to be established on a paying basis.

Mr. Wortendyke said that from October, 1873, the receipts had exceeded the expenses and the surplus had been used in paying interest.

A resolution was adopted providing for the appointment of a committee of seven to look after the foreclosure and prepare a plan of reorganization. The committee will be appointed hereafter by Mr. Smith Ely, Jr., Chairman of the meeting.

St. Louis, Hannibal & Keokuk.

Surveys have been made of a new line from a point nine miles north of Dardennes, Mo., by way of Chain of Rocks, to a point about eight miles southeast of Troy, where it intersects the old grade. It is proposed to abandon the work done on the old grade on account of the heavy rock-cutting required. The company expects to make arrangements for the use of the St. Louis, Keokuk & Northwestern grade for eight miles north of Dardennes.

It has been finally decided to adopt the new line, which will cross the Cuivre River twice on Howe truss bridges. The right of way has been partly secured and contracts are being let. It is intended to have the track laid from Dardennes to Troy by October 1, to save a bonus of $55,000.

New York & Oswego Midland.

It was expected that the decree of foreclosure would be granted this week, and the rival committees are busily urging bondholders to subscribe to their respective schemes of reorganization.

St. Louis, Kansas City & Northern.

A very heavy rain storm followed by a freshet last week destroyed five miles of track on this road, near Salisbury, Mo., besides carrying out a number of bridges. Trains were stopped for seven or eight days, while a large force was employed in repairing the break.

The same storm did a great deal of damage also to the Hannibal & St. Joseph and the Southwestern Division of the Rock Island road.

Michigan Central.

That part of the Jackson, Lansing & Saginaw road north of Wenona, Mich., opposite Bay City, has been made a separate division, and will be known as the Mackinaw Division. The headquarters of both the new division and the Bay City Division (Detroit & Bay City road) have been established at Bay City, Mich.

It is reported the Jackson, Lansing & Saginaw is to be completed through to Mackinaw this season.

Dividends.

Dividends have been declared by the following companies:

Cheshire, 2 per cent., semi-annual, payable July 15.

Delaware & Hudson Canal, 5 per cent., semi-annual, payable August 2.

Erie.

The annual election, July 13, resulted in the re-election of 12 out of the 17 members of the old board. Presidents Packer, of the Lehigh Valley; Sloan, of the Delaware, Lackawanna & Western, and Dickson, of the Delaware & Hudson Canal; Mr. Hotchkiss, a former director, and Mr. Guthrie, of Buffalo, succeed John A. C. Gray, Wm. Butler Duncan, F. Schuchardt, Thomas A. Scott and John King, Jr., the last-named gentleman, however, having resigned some months ago. The successful ticket received 261,735 votes to 750 cast for an opposing ticket, headed (probably without his knowledge or consent) by Cornelius Vanderbilt. The day before the election a meeting was called by Mr. John Livingston to arrange for a new board entirely, but hardly any one attended, and nothing was done.

On application of the Farmers' Loan and Trust Company, trustee, Mr. Jewett has been appointed Receiver in Pennsylvania also.

Sir Edward Watkin has accepted the chairmanship of the London bondholders' committee.

In the old suit to recover from Cornelius Vanderbilt a large amount of money alleged to be due from him, the Supreme Court at general term has set aside the decision of the special term and ordered a new trial.

Central, of Iowa.

The trouble between the Boston and New York bondholders' committees has been compromised, and they have united in a plan of reorganization which they recommend to the parties concerned. This provides for the organization of a new company, to be known as the Central Iowa, which shall take the property subject to the present first mortgage of $3,700,000. The capital stock shall be $6,000,000, of which $907,000 shall be first preferred 7 per cent. stock, and shall be issued for the unpaid coupons on the first-mortgage bonds; $1,167,800 shall be second preferred 7 per cent. stock, to be exchanged for the second-mortgage bonds and unpaid coupons; the remaining $3,925,200 to be common stock, to be exchanged for the floating debt, dollar for dollar, and for the present common stock, one share of new for three of old. The first-mortgage bondholders are to agree to take the net earnings of the road in full satisfaction of their interest claims up to 1881, full interest to be paid thereafter. Until the annual meeting of 1882 the joint committee of the bondholders to have the naming of all the directors, and a sort of veto on all their acts. This putting of the property absolutely into the hands of this committee for seven years is the weak point of the plan, which appears otherwise to be a reasonable one enough. Bondholders will probably object to that feature very strongly.

An Attempt at Train Robbery.

About one o'clock on the morning of July 9, as an east-bound express on the Vandalia line was stopping at the water tank at Long Point, Ill., the engine and Adams express car were uncoupled from the rest of the train and two armed and masked men boarded the engine and ordered the engineman to pull out. He hesitated, when they at once shot him, killing him at once, and ran the engine two miles ahead, when the steam gave out and the engine stopped. The robbers then attempted to get into the express car, but the messenger, seeing that something was wrong, had barricaded the doors and prepared his revolver. The robbers attempted to break in the doors, but before they could succeed the conductor, who had promptly collected all the arms that he could find on the train, and had started in pursuit with a party, came up and drove them off. Several rewards have been offered for the arrest of the men, but thus far without success. The Long Point tank is in a very lonely and secluded spot, and the place was well-chosen for a robbery.

Burlington, Cedar Rapids & Minnesota.

The United States Circuit Court at Keokuk, Ia., has been hearing arguments on the question of appointing a permanent receiver in the foreclosure suit of Charles L. Frost, Trustee, against this company. The Court took the papers and reserved its decision. It is understood that the trustee and others desire the appointment of Gen. E. F. Winslow, President of the St. Louis & Southeastern, as permanent receiver.

St. Louis & Southeastern.

The Nashville (Tenn.) *Union and American* of recent date says: "R. McPhail Smith, as special Chancellor, rendered an important decree yesterday in the case of the State of Tennessee against the Edgefield & Kentucky Railroad. It was a contest between the Louisville & Nashville Railroad and the purchasers of the Edgefield & Kentucky road, involving about $80,000, and growing out of disputed rights of the companies as joint proprietors of the common track from Edgefield Junction to Nashville. The decision was against the petition of the Louisville & Nashville Railroad. An appeal was taken to the Supreme Court."

Michigan Air Line.

A short time since the St. Clair & Chicago Air Line Company, which has for some time owned the eastern end of this road—that is, the portion not leased by the Michigan Central Company—sold its line to some parties in Pontiac who agreed to complete the road. These parties, however, failed to perform their part of the contract, and the St. Clair & Chicago has now conveyed the road to the Michigan Air Line Company. An effort will be made to complete the road.

Ohio & Mississippi.

Notice is given that 36 bonds of the consolidated first mortgage have been drawn for redemption tor the sinking fund, and that they will be paid on presentation at the office of the Union Trust Company in New York, at any time within six months from July 3. The numbers of the bonds are as follows: 61, 3111, 3206, 3383, 3460, 3576, 3645, 3655, 3798, 3851, 3956, 4145, 4152, 4275, 4392, 4533, 4544, 4578, 4588, 4654, 4656, 4766, 4894, 5065, 5231, 5279, 5409, 5642, 5704, 5911, 5941, 6103, 6115, 6224, 6322, 6416.

Toledo, Peoria & Warsaw.

The bridge over the Illinois River at Peoria is being thoroughly repaired, at a cost of about $16,000. The two spans next the draw are being replaced by new ones. These two spans are each 150 feet long, and are composed of wood and iron. The work is done by the Detroit Bridge Company.

Cairo & St. Louis.

The old board of directors has instructed Col. S. S. Taylor, the former President, to keep possession of the books of the company and to refuse to deliver them to the new officers. The ground taken is that the road has not been completed according to contract and that the issue of the stock claimed by the contractors was illegal, and that therefore the late election was illegal also. The agents of the bondholders, however, side with the new board, and there will probably not be much of a contest.

Illinois Central.

The Land Department reports for June sales of 680.04 acres of land for $4,773.68, and cash collections of $29,614.13 on land contracts.

The Traffic Department reports earnings for June as follows:

	1875.	1874.	Inc. or Dec.		P. c.
In Illinois, 707 miles..........	$451,806 11	$567,921 64	Dec..	$116,115 53	20.4
In Iowa, 402 miles....	148,122 10	124,494 89	Inc ..	23,627 21	19.0
Total, 1,109 miles......	$599,928 21	$692,416 53	Dec..	$92,488 32	13.4

The Illinois earnings were $639 and the Iowa earnings $368 per mile worked, the average for the whole road being $541 per mile.

Chicago & Paducah.

Mr. Ralph Plumb, President of this company, writes under date of July 10 as follows: "The writer has just returned from London after having sold sufficient bonds of the Chicago & Paducah Railroad Company to meet all of the liabilities of the company and to put it in such a condition, with respect to finances for the future, as to insure the success of the road. The length of completed line (reaching from Streater to Altamont) is 156 miles, and at the latter place it connects with the Springfield & Illinois Southeastern (now a branch of the Ohio & Mississippi), thus securing a favorable connection with the Baltimore & Ohio system at the South. The connection with Chicago is over the Chicago, Burlington & Quincy. The local traffic of the Chicago & Paducah promises to be more than the interest requirement of its bonded debt demands."

New York & Long Island Bridge.

Mr. G. E. Harding, C. E., has completed the surveys and soundings for the location of the New York & Long Island Bridge. The total length of the bridge and approaches is exactly two miles. The largest spans are 715, 600, 367, 320, and 300 feet respectively. The section comprises a double track, a carriage-way, and two foot-ways. From Third avenue in New York, the railroad will connect with the New York Central & Hudson River tracks, through a tunnel under East Seventy-seventh street, and it will connect with the railroad system of Long Island at the junction of Graham avenue and Lockwood street, in Long Island City. It has been decided to adopt trussed girders. If the bridge is built, those girders will be the largest ever erected.

It is proposed by the company to erect the long span trusses upon the cantilever principle, general designs for which have

been prepared by Mr. G. E. Harding, Acting Chief Engineer, and have been presented to the board and discussed.

European & North American.

The Calais (Me.) *Times* says:

"It is about one generation since Ruel Williams began the railroad between Augusta and Portland. He was at that time in property and ability one of the foremost men in Maine. Seeing railroad failures elsewhere, he determined not to commence his road until it was amply provided against disaster. When a good stock subscription was made of something more than $20,000 to the mile he began. The result was—after years of struggle—the loss of the subscription and a personal loss to Mr. Williams of something over $200,000, an immense sum in those days. Luckily his fortune was able to bear the strain.

"The Back Route, as it was called, the road from Danville Junction to Kendall's Mills, was built about the same time. No men of note were engaged in it, and the pecuniary upset of the board of directors was not so much noticed as Mr. Williams' loss. Then came the road from Kendall's Mills to Bangor. Mr. Moore, of Waterville, a man of intellect and moderate pecuniary means, wrestled with the enterprise some years and got thrown. But individual disaster did not prevent the completion of these roads, which now form the chief value of the Maine Central.

"The history of these roads was entirely familiar to Mr. Jewett of Bangor. He was a gentleman of established wealth. It was as certain as such things ever are that he and his business associates could pay their debts and then divide $1,500,000. But the railroad fascination was too strong and drew him in. The problem was to build a railroad from Bangor to St. John—a distance of 200 miles.

"By pressing and skillful effort on both sides the line, large grants had been obtained. Maine began by a donation of public lands, giving some five or six hundred thousand acres. The General Government added about $800,000 in greenbacks. New Brunswick gave $10,000 a mile in gold and subscribed and paid $300,000 in addition. The city and citizens of St. John contributed some $100,000. These gratuities could not be estimated at less than $2,500,000, or something more than $12,000 a mile. In addition to these means bonds were issued on the Maine end of the road to the amount of $3,000,000, one-third of which was guaranteed by the city of Bangor. The New Brunswick end was bonded for $2,000,000, and $1,000,000 was issued by the united road, making $6,000,000 in all.

"Mr. Jewett is a careful and skillful manager of property. He has raised money in amounts that few other men in Maine would be able to do. But the result of it all is that the railroad was stronger than he. These vast sums have all been swamped in its insatiate maw, and another instance has been added to the long list of railroad disasters."

Columbia Conduit Company.

This company has begun the transportation of oil to Pittsburgh through its pipe line. The break in the pipe at the crossing of the Western Pennsylvania road still continues, and oil is transferred over the railroad track in tank wagons, holding 25 barrels each. It is said these wagons can be loaded in one minute and unloaded in less than two.

Des Moines & Fort Dodge.

It is reported that negotiations are in progress for the transfer of this road to the Keokuk & Des Moines Company, which would once more unite the old Des Moines Valley road under one management.

Pensacola & Louisville.

It is now proposed to extend this road from the junction with the Mobile & Montgomery road northward about 67 miles, to Pine Apple, Ala., the southern terminus of the Selma & Gulf road. That road and the Selma, Rome & Dalton could be used to Ashby, whence some 25 miles of track would bring the road to the South & North Alabama, near Cahaba. The last named section, indeed, could be omitted altogether without much affecting the directness of the route.

Louisville, New Albany & St. Louis.

At a meeting of the directors recently, it was resolved to oppose the foreclosure proceedings, but to offer no resistance to the appointment of a receiver, or to any action of the bondholders looking towards the completion of the road.

East Broad Top.

A special meeting of the stockholders will be held in Philadelphia, August 19, to vote on a proposed increase of the capital stock.

Hot Springs Branch.

The grading and bridging is progressing rapidly and tracklaying has been begun. Arrangements have been made to open the road for business as soon as the track reaches Tigre, the half-way station.

Missouri, Kansas, & Texas.

Our Amsterdam correspondent writes, under date of June 27: "The most important fact of the week was the advertisement of the committee of the Missouri, Kansas & Texas Railway Company that a meeting will be held July 26 for considering the proposals for an arrangement to obviate a foreclosure. The proposals are not yet published by the committee, but I can tell you what the principal conditions are. The hypothecated Boonville Bridge and Fort Smith bonds to be accepted by the bondholders in payment of their dues. Thus the first mortgage bonds will be increased by this amount, and the floating debt diminished in proportion to the price at which they are accepted in payment. For the balance, income bonds will be given to the floating debt creditors. The conditions of the management will be embraced in the second mortgage instrument. The first mortgage bonds (the committee means the Missouri, Kansas & Texas bonds, though they are a subordinate lien so far as there are outstanding bonds of the Union Pacific Southern Branch), will have their coupons, due in 1874 and 1875, paid in second mortgage income bonds, bearing 6 per cent. currency interest, after the payment of the first mortgage coupons, or such smaller interest as the surplus will be sufficient to make up; from 1876 to 1878 the company promises 4 per cent. gold, and 3 per cent in these income bonds; from 1879 to 1881, 5 per cent. gold, and 2 per cent. income bonds; in 1882, and thereafter, full gold interest. Three-fourths of both the Union Pacific Southern Branch and the Missouri, Kansas & Texas loans were sold here, and nearly all of the former, so we have the right to look sharp and make our own conditions. The company failed to carry out the former arrangement, and now, when the earnings are decreasing, the company promises more. * * * What we want is Holland trustees, Holland directors, or, since the Americans oppose this as long as possible, a Hollander as agent or commissioner, appointed and paid by the Holland bondholders, and not removable by the company. In this case, the Holland public would be content with a less payment even. The more and the better the guarantees given by the company, the more will its own interests be fostered, and the more will confidence be revived, and Holland capital, which has turned its back on the company, will flow again to the far West, if our capitalists shall be convinced of the sincerity of the interested parties."

Rochester, Nunda & Pennsylvania.

It is reported that the Erie will lease the section of 20 miles, from Mt. Morris, N. Y., to Swain's, on which track was laid last year, and will put it in order and operate it.

Chicago & Northwestern.

Our Amsterdam correspondent writes June 26: "There was a large business in Chicago & Northwestern preferred, because the Amsterdam administration (which has issued certificates which alone are salable on our Stock Exchange) announced that the company will, when the charter and the State laws permit, issue $10,000,000 more common stock. Our public approve this measure, as very little common stock is held here. I do not know whether the American holders of common stock public will approve this watering, as their position in this respect differs very much from ours."

Atchison, Topeka & Santa Fe.

Our Amsterdam correspondent writes concerning these bonds, June 26: "The market has been growing better continually for some months past. They have advanced 15 per cent. in less than a year, and this week they rose 3. The resumption of railroad building, the great sales of land, and the excellent administration of the land department by Mr. Touzalin and his active agent, Mr. Schmidt, are among the chief causes of this better feeling."

Eastern Shore.

The annual meeting was to have been held at Princess Anne, Md., July 6, but no quorum was present. During June 365 car-loads of strawberries passed over the road, the largest amount ever carried.

Southern Pacific.

The track on the extension of the Los Angeles Division southeastward is now laid to a point 28 miles from the old terminus at Spadra, Cal., and 56 miles from Los Angeles.

Little Rock & Fort Smith.

In the United States Circuit Court at Little Rock, Ark., a bill has been filed asking the Court to review and set aside the foreclosure sale of the road, and to order a new sale.

Atlanta & Richmond Air Line.

Mr. Julius M. Patton, Special Master appointed by the United States Circuit Court for Northern Georgia, gives notice that for the purpose of taking testimony as to the bonds and other debts of the company, as directed by the order of the Court, he will sit at the following places and times: In Atlanta, Ga., July 19, and August 4; in Greenville, S. C., July 21; in Charlotte, N. C., July 23; in Richmond, Va., July 26; in New York, at the Fifth Avenue Hotel, July 29. At each place the session will begin at 10 A. M., and will be continued from day to day, if necessary. All holders of bonds or other claims are required to present their claims, with evidence, at one of the above named sessions.

Fitchburg.

Eight different lines have been surveyed for the proposed new line or cut-off on the Vermont & Massachusetts, which is to avoid the long detour to Ashburnham and the heavy grades about that place. The final location has not been made.

A large new freight depot has been built in Boston to accommodate the through business by the Hoosac Tunnel line.

Illinois & St. Louis Bridge.

English journals of June 26 mentioned a report that the interest on the second-mortgage bonds would not be paid. The London quotations for the company's securities at the same date were 85 to 90 for the first-mortgage and 50 to 60 for the second-mortgage bonds.

Burlington & Missouri River in Nebraska.

The general offices of this company have been removed from Plattsmouth, Neb., to Omaha.

Port Royal.

Mr. D. C. Wilson, President of the company, has been appointed Receiver on application of the bondholders and other creditors.

Rome, Watertown & Ogdensburg.

Under date of July 12, a correspondent writes as follows concerning the progress of the Lake Ontario Division: "The track of this division has reached a point nine miles west from Charlotte, N. Y., the point to which it was completed last year, and is being rapidly pushed westward. The road-bed and bridges are ready for it 14 miles in advance. Throughout the whole distance to Lewiston, 75 miles, rapid progress is being made, many sections at various points being already completed. The company hopes to have the track all laid this year.

"The substructure for the Genesee Bridge is complete, and the superstructure will soon be erected. Considerable work has already been done on the iron viaducts at Eighteen-Mile and Oak Orchard creeks. These structures are to be 390 and 750 ft. long and 73 and 87 ft. high above the bed of stream, respectively.

"Work has been commenced for the substructure of the Oswego railroad bridge by John Hunter & Co., contractors, a well known and responsible firm. It is expected that this bridge will be completed in three months. It is to be a double-track iron bridge, 828 ft. long over all, with 60 ft. of iron trestle at the east end. This bridge will be the connecting link of the four railroads centering at Oswego. It is to be owned by the Oswego Railroad Bridge Company, and to be constructed under the supervision of the engineers of the Rome, Watertown & Ogdensburg road, Lake Ontario Division."

Fort Smith, Fayetteville & St. Louis.

Efforts are being made to raise money in Northwestern Arkansas for a railroad from a convenient point on the Little Rock & Fort Smith road northward to Fayetteville, Ark., and thence into Missouri to a connection with the Atlantic & Pacific.

Atchison Bridge.

The Atchison (Kan.) *Patriot* says: "The work of building the piers of the great bridge is almost finished. The stone work on all of them is done, save the one on the eastern shore, and it is down within ten or twelve feet of bed rock. The false work on which the superstructure will be built has been commenced, and the placing of the iron superstructure will probably be finished from the eastern abutment to the pier by the time the latter is ready to receive it."

Utica, Ithaca & Elmira.

Tracklaying is now in progress on the gap between Ithaca and Wilseyville. Two gangs are at work, one from Ithaca southward, the other from Candor northward. The rails are being received as fast as needed from the Elmira rolling mills.

Kentucky Central.

The Cincinnati *Commercial* gives the following as the provisions of the sale of the interest of Covington city in this road:

"The city transfers the entire claim upon the road to the purchasing party, foregoing all future recourse, for the sum of $250,000 in cash or its equivalent.

"Mr. William Ernst, trustee for the purchaser, agrees on its behalf to pay $50,000 in cash, the $200,000 remaining to be held for taking up the bonds of the city due in 1883. These bonds bear interest payable semi-annually at 6 per cent. The interest the purchaser agrees to pay from the first of the current month. To secure the discharge of the principal at the time when it falls due, the purchaser deposits as collateral $100,000 in second-mortgage bonds of the Covington & Lexington Railroad Company, which have become first-mortgage bonds by the payment of those which had precedence. These bear 7 per cent. interest, payable semi-annually. Messrs. George H. Pendleton, Wm. Ernst, John W. Stevenson, George P. Bowles and James C. Gedge have given their individual guarantee of the faithful performance of the above contract. The deposit of $100,000 was placed with the Covington City National Bank, and will be subject to the order of the City Council in case the contract is violated. Peter Zinn has relinquished all claims against the city for services."

Central Vermont.

In the United States Circuit Court for Vermont, June 28, a bill was filed by the Connecticut River Railroad Company against the Rutland and Central Vermont railroad companies, praying that the courts shall decide whether the Connecticut River Company shall pay the orders heretofore accepted by them in favor of the Rutland Railroad, toward the rent of the Rutland Railroad, and asking that the orators may pay the money into the registry of the court to await its decision as to who are entitled to the funds. The case has been made returnable at the August term.

The temporary injunction granted in the suit between the rival boards prevents the transfer of any of the new stock, the levying of any assessment on it or its recognition in any way until its legality is decided.

Knoxville & Charleston.

An effort is being made to have the City of Knoxville, Tenn., subscribe $250,000 to the stock of this company on condition that a sufficient additional amount be raised to complete the road to the terminus of the Blue Ridge road at Walhalla, S. C.

Boston & New York Air Line.

The conveyance of the old New Haven, Middletown & Willimantic road to the new company under the foreclosure has been made and duly recorded. Already $1,563,000 of bonds have been surrendered, to be exchanged for stock in the new company, and others are coming in. A special meeting of the stockholders has been called for July 23, at Middletown, Conn., to vote on the issue of $500,000 new bonds provided for in the organization of the company.

Monticello & Port Jervis.

This road was sold at Monticello, N. Y., July 7, under foreclosure of mortgage. It was purchased by the first-mortgage bondholders of the road, represented by Messrs. Day, Depeyster and Knox, trustees. It will be run for the present just as it was heretofore. The price paid was $165,000. The road is 24 miles long, from the Erie at Port Jervis, N. Y., northward to Monticello, and had a bonded debt of $650,000. The net earnings for the last fiscal year were less than 1 per cent of the debt.

Boston & Maine.

Of the new agreement with the Eastern Company the Portland *Argus* says:

"It is stated that the agreement for the pooling system between the Boston & Maine and Eastern had been signed once, when the latter road were desirous of inserting some further provisions, which caused disagreement, and the whole scheme fell through."

The Delaware Peach Traffic.

Arrangements have been made for forwarding peaches to Boston from Delaware, the cars to be transferred on floats from Jersey City to the Harlem River freight docks of the New York, New Haven & Hartford road. The time from Middletown, Del., to Boston is to be 36 hours.

Arrangements have also been made to forward peaches over the Pennsylvania road, and the following proposition from that company has been accepted by the Shippers' Convention: Peaches, when in train loads of not less than six cars (leaving Philadelphia), three of which are to be through cars to Pittsburgh, and the remainder may be dropped off on the route, the following rates per car-load of 16,000 pounds will be charged: To Lancaster, $75; Harrisburg, $85; Mifflin, $105; Lewistown, $110; Huntington, $120; Tyrone, $120; Altoona, $130; Johnstown, $140; Greenstown, $150; Pittsburgh, $150.

Peaches in less than full train, as above, the rates will be as follows: Lancaster $90, Harrisburg $100, Mifflin $120, Lewistown $125, Huntington $130, Tyrone $140, Altoona $150, Johnstown $175, Greenstown $200, Pittsburgh $215. The cars whether in full trains or not, to leave Philadelphia on the Pittsburgh through express at 6:10 p. m., and will arrive at Pittsburgh at 7:15 a. m. Time is not guaranteed, and the company take no risks. Peaches from Philadelphia to Buffalo, Elmira, Canandaigua and Rochester, New York, $250 per car of 16,000 pounds, when in less than full train loads of six; when six cars furnished (leaving Philadelphia), three cars going through and three dropped on the way, the rate will be $200 per car, to leave West Philadelphia at 11:15 p. m. and arriving at Buffalo at 8 p. m. (second day). The company will furnish good cars and the best of ventilation. The Baltimore & Ohio has also offered through rates to Pittsburgh.

The English Continuous Brake Trials.

In our last number we described in general terms the various brakes submitted for trial during the experiments recently carried out on the Midland Railway under the direction of the Royal Commission on Railway Accidents, and we now have to record the results of the experiments made with these brakes, and to point out the conclusions which may be deduced from them. * * * * * * * * * *

The composition of the various experimental trains was also described in our last number, but we may repeat here that they all consisted of fifteen vehicles, namely, thirteen carriages and two brake vans, the carriages being in some cases six-wheeled and in others four-wheeled, as we explained last week. * * *

A.—EXPERIMENTS ON STOPPING TRAINS BY TENDER AND VAN BRAKES ONLY, WORKED BY HAND.

In carrying out this class of experiments, five trains only were tested, namely, the London & Northwestern, the Caledonian, the London, Brighton & South Coast, the Great Northern, and the Midland train, fitted with Clark's hydraulic brake. This latter train was taken as a fair representative of the three Midland trains, while the Lancashire & Yorkshire train fitted with Fay's brake was unfitted for trial in this class, it not being possible to work the van brakes apart from the continuous brakes without temporarily breaking the connections between the vehicles. In carrying out this set of trials the trains were each started from the regular starting point, thus giving them rather more than three miles' run to get up speed, and the brakes were applied on the engine passing post No. XXIV., the fireman then applying his tender brake and the driver whistling to call the attention of the guards, who were in addition signalled by a sapper on the engine holding out a flag, which could be seen by observers on the look out from the guards' vans. The stops thus made represent the best results attainable with ordinary tender and van brakes worked by hand, as both the firemen and guards knew beforehand the point at which the signal would be given, and were therefore in readiness to act with the utmost promptness.

The first train tried was that of the London & Northwestern Railway Company, and the results are recorded in the first line of our table. This experiment calls for no comment, the stop made being simply an exceedingly good one, considering the conditions we have described. We may remark here, by the way, that the running of this train was for ease and steadiness all that could be desired.

The next train tried was the Caledonian, fitted with Steel & McInnes' air brake. This train ran very roughly, and the stop made was far from being so good as those attained by the London & Northwestern train, although it was better than those made by trains subsequently tested. The results will

be found in the second line of our table. Next in order came the London, Brighton & South Coast train—a train especially noticeable for its steady and easy running. The engine drawing this train was fitted with a brake applied to the driving and trailing wheels, and capable of being applied by either steam or hand; but this brake was not used in the trial now under notice, the fireman putting on the tender brake only. It may be mentioned that a slight shower fell just before this trial, but the rails were practically dry before the train reached the point where the brakes were applied, so that the rain cannot be regarded as having any effect upon the result. A more important point was that the cast-iron brake blocks of this train had been only newly fitted and the "skin" had not worked off them, nor had they become properly bedded to the wheels. This state of affairs of course diminished the holding power of the van brakes, and to this cause the distance run before stopping was no doubt to some extent due. Another cause which also contributed to this result was the lowness of the frictional resistance of the train as shown by the subsequent experiment made to determine that point. The results of the trial of the Brighton train in the "A" experiment are duly given in our table.

The fourth train tested was that sent by the Great Northern Company. This, as will be seen by our tables, was the heaviest train on the ground, but the weight resting on the wheels to which hand brakes could be applied formed a fair percentage of the whole, as will be seen on comparingthe several figures in column 10 of our table. The "A" trial of this train was made in a heavy rain, and as all the brake blocks operated by hand were of wood, this wet weather was of course a disadvantage. The train ran very easily.

Fifth in this set of trials came the Midland train fitted with Clark's hydraulic brake, this train being taken as fairly representing the three trains sent by the Midland Company. The engine attached to this train had brakes fitted to the coupled wheels, but these brakes were not used during the experiment now under notice. As will be seen from the table, the stop made was a fairly good one under the given conditions. The rails during the experiment were still wet although the rain had stopped.

Before dismissing this series of trials we may say a few words in explanation of column 9 of our table which gives the approximate weight resting upon the wheels to which brakes were applied during the experiments. These weights have, in the case of the "A" series of trials, been calculated on the assumption that the weight of the brake vans might be taken as about equal to the mean weight of the vehicles composing each train, the weight of vans thus estimated being added to the weight of the tender, to form the totals given in column 9. An exception to this has, however, been made in the case of the Caledonian train, the vans of which were unloaded. In this case the weight of the vans has been taken as 7 tons each. In the case of the London & Northwestern train also, where the brakes are applied to four wheels of the vans only, the weight resting on these wheels has been taken as $8\frac{1}{2}$ tons, or rather more than two-thirds the weight of each vehicle. It is believed that the assumptions here made involve no error of importance; but in any case the matter is one of minor consideration, as the "A" series of trials can only be regarded as interesting from the fact that they form a certain basis of comparison from which the powers of the continuous brakes can be judged.

B.—EXPERIMENTS ON STOPPING TRAINS BY TENDER BRAKE, VAN BRAKES AND CONTINUOUS BRAKES APPLIED BY GUARD ON FLAG OR CORD SIGNAL.

In this series of trials, as in that preceding, the order to apply the brakes was given on the engine passing post No. XXIV., the signal being conveyed to the guards in the same manner as before. The first train tested was the London & Northwestern, fitted with Clark & Webb's chain brake, and in this experiment a mishap occurred, the application of the brakes causing the train to part between the seventh and eighth vehicle from the front, and the passengers getting somewhat shaken. As we explained last week, this brake can be applied by a cord worked from the engine or from either van, this cord withdrawing triggers, which in their normal position hold the brake levers and keep the friction drums on the chain winding axles out of gear with the corresponding friction wheels on the van axles. In the present instance, however, this arrangement was not used, each guard applying his brake independently, and it has been supposed that the fracture must have been caused by the rear guard having applied his section slightly before that on the front section was applied by the other guard. However this may be, the train parted at the point we have mentioned, breaking a good sound draw-hook and both safety chains, the two portions of the train being 169 ft. apart when they both came to a stand. The first portion was about 1,400 ft. from the point of application of the brake, and the broken portion of the draw-hook was found 554 feet back from its own carriage, so that the train must have run some 850 ft. or so after the application of the brake before the rupture took place. This would tend to show that the fracture can scarcely have resulted from any difference in time of application of the brakes to the front and rear sections, but rather from some strain set up by the action of the brakes after they had been applied. The fact is, that this arrangement of brake throws very severe strains upon the drawbars, and a remarkable instance of this occurred one day when the London & Northwestern train was on its way down to the trial ground, the application of the brake by pulling a cord leading to the engine, causing the drawbar of the front carriage to be extended no less than $7\frac{1}{4}$ in. in a length of 9 ft. 8 in. The drawbar was $1\frac{1}{4}$ in. in diameter, and the fact of its enduring this sudden extension cold, was an admirable testimonial as to the quality of the iron. Several of the other drawbars in this train were also stretched to a less extent.

The next train subjected to the "B" trial was the Caledonian, fitted with the Steel & McInnes brake, this making a stop which was far from good, as a reference to our table will show. The leakage of air in this brake appears to be very considerable, as indeed might be expected from its arrangement, the whole of the piston-rod stuffing boxes of the brake cylinders being at all times exposed to the full air pressure. In this respect the Steel & McInnes differs most materially from the Westinghouse air brake, there being in the latter no piston-rod stuffing boxes to the brake cylinders, while the air under pressure is only admitted to these cylinders at the time when a stop has to be made.

The third train in the present series was the London, Brighton & South Coast train, fitted with the Westinghouse vacuum brake, the brake being in this instance applied by the driver. This train ran even a little further than the Caledonian, but the speed at the time the brakes were applied was considerably higher than in the last trial, so that, taking this into consideration, the stop made by the Brighton train was the better of the two, as the comparative figures in column 48 of our table will show. It is certain, however, that the Westinghouse vacuum brake did not work so well as it should have done throughout the experiments, and the cause was, we believe, subsequently discovered to be due to some defect in the steam supply to the ejector. This is to be regretted, as the arrangement is well worked out, and on the Brighton line has given excellent results, the action of the ejector being particularly effective.

Next came the Lancashire & Yorkshire train with Fay's brake, and this, as will be seen from the table, made an excellent stop. There can in fact be no doubt that Mr. Fay's arrangement, when in good order and with the blocks carefully adjusted, gives excellent control of a train; its costliness, however, and general inadaptability to traffic requirements, render it quite unfitted for general application.

The fifth train subjected to the "B" trials was the Great Northern, fitted with Smith's vacuum brake, and this, as will be seen from our table, made a good stop, albeit that the speed at the time the brakes were applied was rather low, a circumstance no doubt partly due to the fact that a number of the brake blocks did not draw back properly clear of the wheels, and hence the engine could not get up speed. The brake in this experiment was applied by the aid of the two exhausters driven from the van axles, and by the guard pulling a cord which was led to the engine and attached to the handle admitting steam to the ejector.

The next train brought forward for trial was one of the Midland, fitted with Barker's hydraulic brake. Unfortunately, however, while standing waiting for its turn, the engine had run short of water, only about nine inches being left in the tender, and this quantity having become heated from the discharge into it of the waste water from the hydraulic accumulator cylinder, this accumulator having been at first worked, as we explained last week, with water drawn from the boiler. The water remaining in the tender being thus heated, the injectors refused to act, and in the middle of the run to get up speed, the train had to be stopped and the fire put out by shovelling ballast into the firebox. Luckily steam was got down and the fire extinguished without doing any damage, but the trial had of course to be postponed until another day. In the mean time Mr. Barker altered his mode of actuating the accumulator, and arranged to use steam instead of water from the boiler, this being a decided improvement. The results of the trial with the brake thus altered are given in line 11 of our table. Concerning this and the other trials of this arrangement, it is only just to Mr. Barker to state that the brake gear had only been supplied to the Midland Company a few days before the trials, and it was only by working night and day that the train was got ready at all. Under these circumstances not only had Mr. Barker's own endurance been severely taxed, but he had of course no opportunity of making those experiments and adjustments which are so essential in all new things of this kind.

The next Midland train, fitted with the Westinghouse automatic brake, made, as will be seen on reference to our table, by far the best stop in the "B" series of trials, the distance run being only 4 ft. greater than with the Lancashire & Yorkshire train, while the speed at the moment the brakes were applied was $7\frac{1}{2}$ miles per hour greater, a most important difference. In this trial the communication between the brake cylinders on the engine and the air pipes was shut off so that the engine brake was not applied, the automatic arrangement, however, actuating the tender brake.

The last trial of this series of which we have to speak was that made with Clark's hydraulic brake fitted to another Midland train. As will be seen on reference to our table, this train made an excellent stop, the hydraulic arrangement acting upon the tender brake and brakes of the eight first carriages, while the two van brakes were applied by hand.

C.—EXPERIMENTS ON STOPPING TRAINS BY THE APPLICATION OF ENGINE, TENDER AND CONTINUOUS BRAKES, NO SAND BEING USED.

In this series, as in the two preceding, the signal to apply the brakes was given on the engine foot-plate on passing Post No. XXIV., and the continuous brakes were applied by the driver when it was in his power to do so, or by the guards on their observing the signal. The experiments, in fact, represented stops that would be made under the supposition that the driver saw danger, sand, however, not being used.

The first train tested under these conditions was the Caledonian, in which, of course, the continuous brake could be applied by the driver. This trial was made in a heavy rain, and the stop was by no means good, as will be seen on reference to the table. Next came the London, Brighton & South Coast train, which was also tried while the rails were wet, and which, like the Caledonian, made a decidedly indifferent stop, a result partly due to the steam brake on the engine not acting properly. This brake had been arranged to be supplied with steam by a branch from the same boiler mounting, from which steam was led off to the ejector for producing the vacuum in the brake pipes, but it was found that when the latter was at work a totally insufficient supply of steam reached the cylinder of the engine brake, and thus the latter was not applied. Unfortunately this was not noticed until too late, or the engine brake might have been applied by hand, provision being made for that purpose.

Third in this series was the Lancashire & Yorkshire train, which, as before, gave a very good result. The rails during this experiment were still wet, although the rain had stopped but inasmuch as the Lancashire & Yorkshire Company use wooden brake blocks, having in them holes plugged with a mixture of resin and sand, this wetness was of minor importance. It is to be noted that this stop was made from a lower speed than any other in the series.

Next in order was the Great Northern train, fitted with Smith's vacuum brake, this making a fair, but by no means very good stop, as our table will show. The Great Northern train was in this trial drawn by the Northeastern engine, having the vacuum brake applied to its coupled wheels so that the brakes on the engine, tender and carriages were all applied by the vacuum arrangement. The exhaustion of the air, as in the former trial, was affected partly by the pair of ejectors on the engine and partly by the two exhausters driven from the van axles as already explained. The Great Northern train was followed by the London & Northwestern, with Clark & Webb's brake, the brake having in this case been disconnected on the ninth, tenth and eleventh vehicles, so that the front van actuated the brakes on four carriages in front of it and three behind it, while the one at the rear of the train operated the brakes on three carriages only. The stop made under these conditions was, as shown by column 48 of our table, about equivalent to that made by the Great Northern train, the distance run being somewhat less, but the speed being less also. The rails were dry during this experiment.

Next came the Midland train, fitted with the Westinghouse automatic brake, and this made a splendid stop, the train, when running at 52 miles per hour, being arrested in 913 ft. A good deal of nonsense has appeared in the columns of some of the daily papers respecting the shaking said to be caused in all cases by the application of the Westinghouse brake. Nothing could be more erroneous, as the Westinghouse brake, when properly handled, affords the means of making more easy stops than any continuous brake with which we are acquainted. It is quite true that, on some occasions (not during the regular trials), some jerking was felt on the application of the Westinghouse brake to the Midland train; but this was due, not to any fault in the system itself, but to the brake being released too rapidly and then reapplied, and so on. When so operated any powerful continous brake would produce jolting. In the particular cases we refer to, due allowance must be made for the fact that the driver of the train in question had never had any experience with this or even the older arrangement of the Westinghouse brake, prior to the trials, and this, although to its disadvantage in some respects, was in other ways a testimonial in favor of the brake, as it showed that special skill or training was not required to insure good stops being made with it. As regards the jolting alleged to have been produced by the action of the brake, perhaps the best commentary on the statements of the daily press is to be found in the fact that on the occasion of one of the smartest stops being made, two of the gentlemen composing the Royal Commision were asleep, and the application of the brake never awakened them. This we think may be taken as very fair "circumstantial evidence" as to the mythical severity of the alleged jolting due to the action of the Westinghouse automatic brake.

Next in this series was the Midland train fitted with Clark's hydraulic brake, this making a good stop, considering that the continuous brake was applied to but eight carriages. It is, however, questionable as to how far the arrangement of pump or accumulator fitted by Mr. Clark to the engine is adapted for working brakes applied to the whole of a long train, as, if more than one stroke of this pump had to be made to apply the whole of the blocks, it is not improbable that any advantage due to the appliance of the brake blocks to a greater number of wheels might be more than counterbalanced by the want of promptness in bringing them all into action.

Last in the trials now under notice came the Midland train fitted with Barker's hydraulic brake, but this made by no means so good a stop as those who have witnessed the operation of Mr. Barker's other hydraulic brake on the Great Eastern line might have been led to expect. This result was, no doubt, to some extent due to the causes we have already mentioned, and we can only regret that Mr. Barker had not the opportunity of showing his brake under more favorable conditions.

D.—EXPERIMENTS ON STOPPING TRAINS BY THE APPLICATION OF ENGINE, TENDER AND CONTINUOUS BRAKES, SAND BEING USED AND THE ENGINE BEING REVERSED IN CASES WHERE NO ENGINE BRAKE IS FITTED.

This series of trials was conducted in precisely the same way as the last, with the exception that sand was used and the engines reversed in cases where no engine brake was fitted. These experiments, in fact, represented cases in which the driver did everything in his power to stop on receiving the signal.

The first train tried on this series was the Caledonian, the results which are duly recorded in our table, calling for no special notice. Next came the London, Brighton & South Coast train, fitted with the Westinghouse vacuum brake, this making a very indifferent stop. In this case the self-acting sand-boxes supplying sand to the engine driving-wheels did not work, the sand having become caked hard. The tender had sand pipes supplied by hand only, while the vans were without sand-boxes. The next tried was the Lancashire & Yorkshire train with Fay's brake, the engine in this case being reversed. The only sand used was, we believe, that supplied by the tender sand-boxes. A very general impression prevailed among those present that in this trial the brake belonging to the rear section of the train was applied before the signal was given; but nothing positive can be stated on this point. The results are given in line 25 of our table. Later on in the trials another similar experiment was made with the Lancashire & Yorkshire train, the train, however, in this second instance being drawn by the Northeastern engine, which as we have already mentioned was fitted with Smith's vacuum brake applied to both the coupled and tender wheels. The results of this second trial will be found in line 23 of our table.

Fourth in this series was the London & Northwestern train, the brakes being arranged in the same manner as in the "C" series. The stop made was a good one, as will be seen on reference to line 26 of our table, but we cannot state positively whether or not the engine was reversed. By far the best stop of this series, however, was made by the Midland train fitted with the Westinghouse automatic brake, this train pulling up from a speed of 52 miles per hour in a distance of 280 yards, as recorded in line 22 of our table. This wonderfully prompt stop was made without shock, and it was, in fact, during this trial that the two members of the Royal Commission enjoyed their nap of which we have already spoken.

Next in our list of the order of trials in this series, is the Great Northern train drawn by the Great Northern engine. This was tried at a time wher the rails had become thoroughly well sanded by the previous experiments, and it made a good stop, although one which was vastly inferior to that of the train fitted with the Westinghouse automatic brake, as a comparison of the two results in lines 24 and 22 of our table, respectively, will show. The engine was reversed and sand applied in front of the driving wheels. This trial was made on the 12th inst., but on the 14th the experiment was repeated, the stop being then made in a shorter distance, but the speed being less, so that the performance was really not quite so good as the former one. The particulars of this second trial are given in line 29 of our table. Clark's hydraulic brake was not tried in this series, but Barker's was tested with results recorded in line 27 of our table.

It will be seen that in our table the various stops made in each series of trials have been arranged in the order of their efficiency as judged by reducing each performance to its equivalent made from a speed of 50 miles per hour, the distance run after the application of the brakes being assumed to vary on the squares of the speeds. These equivalent performances are recorded in column 48 of our table, and an examination of them will at once show the high position taken by the Westinghouse automatic brake in the series of trials of which we have just been speaking.

E.—EXPERIMENTS ON STOPPING TRAINS ON A SIGNAL GIVEN TO THE REAR GUARD, OR AT SOME INTERMEDIATE POINT IN THE TRAIN, THE DRIVER BEING THEN SIGNALLED TO APPLY BRAKES.

This series of experiments represented cases in which danger was supposed to be discovered either by the rear guard or by a passenger, and the arrangements for carrying it out differed somewhat with the different brakes, the signal to stop being, however, in all cases given to the rear guard by some one riding in his van. The first train tested in this series was the London & Northwestern, the brake arrangements of which had been somewhat modified since the last run made with it. Thus, instead of the brakes of three carriages being disconnected, one only was detached, this being the eleventh vehicle from the tender. Thus the chain drums on the front van actuated the brakes on four carriages in front and five behind it, while from the rear van there were only worked the brakes on three carriages. In the particular trial of which we are now speaking the mode of procedure was as follows: The rear guard on receiving a signal in his van, pulled a cord and blew a whistle on the engine. The driver then reversed and applied steam against the engine, and at the same time pulled a cord to apply the continuous brakes, the fireman simultaneously applying the tender brake, while a third person fed sand through the tender sand pipe. Considering the time which must necessarily be lost in signalling the driver, the stop made was a very good one, but all who have had experience with cord communication on railways must know that the dependence to be placed on any such arrangement is exceedingly slight, and that it is nearly sure to fail when most urgently required.

The next train in this series of trials was the Caledonian, with Steel & McInnes' brake. In this case, owing to the way the train was made up, the signal had to be given in the fifth vehicle from the front, this being a third-class with a guard's compartment. The guard on receiving the signal pulled a handle, and by so doing released the air from the pipes and applied the brakes, at the same time sounding a whistle on the roof of the van. The driver on hearing this shut off steam and reversed his engine, the fireman at the same time applying his tender brakes, and the guards in the two vans at the rear of the train their hand brakes. The rails were wet during this trial, but sand was used and the stop made was a very good one. It is to be borne in mind that the fact of the brake being applied from the middle of the train was a decided advantage in this experiment, as the compressed air was discharged simulta-

neously from the pipes on the carriages before and behind the fifth vehicle. Of course under these circumstances the air was discharged—and the brakes consequently applied—more promptly than would have been the case had the opening been made at one end of the train only. This was shown by a subsequent experiment of which we shall have to speak in due course. It may be remarked that the experiment which we have just described practically represented a case in which the brake was applied and the driver signalled by a passenger riding about the middle of the train.

The London, Brighton & South Coast train was another with which a stop was made on a signal given by a passenger. In this case a handle was pulled in the fourth carriage from the front, and a signal was thus given, through the system of electric communication with which the train is fitted, to both guards. The front guard then signalled the driver by ringing a bell close to the ear of the latter, and the driver then shut off steam, applied the steam brake on the engine and the continuous vacuum brake on the train, the fireman at the same time putting on the tender brake and applying the sand. The time occupied in making the stop was 32 seconds; but the time during which the continuous brake was actually applied was 28 seconds, 4 seconds being thus lost in signalling.

Next in order came the Lancashire & Yorkshire train with Fay's brake. In this case it was proposed to give the signal by a cord from the rear van, but the cord was found to be useless, and the order to apply the brakes was, therefore, given in the front van, the rear guard applying the brakes on his section as soon as he felt the application of the brakes in front, and the driver shutting off steam while the fireman applied the tender brake. The stop made was a good one, as will be seen on reference to line 34 of our Table. Next came Clark's hydraulic brake, the signal being in this case given to the driver by the cord pulled from one of the carriages, the driver on receiving the signal shutting off steam, applying the continuous brakes, reversing the engine, and applying the steam against the pistons.

Last in this series was tried the Midland train fitted with the Westinghouse automatic brake, the signal in this case being given from the carriage next the rear van. The act of giving the signal in this case also began to apply the brakes, but the driver on receiving the signal also applied his brake and shut off steam. The official time booked for this stop from the time of giving the signal was 22 seconds, but we believe that the time booked by the official observer on the engine as elapsing after the application of the brakes by the driver, was only 14 seconds. The period during which the application of the brakes was actually felt by passengers riding in one of the front carriages was but 12 seconds. Altogether, this experiment could scarcely be deemed as satisfactory, and it certainly compares unfavorably with some other trials of a similar nature, but differing slightly in detail, made with the same brake on the following day. In the case of the Great Northern train the signal was given from the third vehicle from the rear, but in the first trial the cord did not act properly, and the experiment was repeated after the cord had been specially adjusted. The details of the two trials are given in lines 35 and 38 of our table. The Midland train, fitted with Barker's hydraulic brake, was not tested in this series of trials.

F.—EXPERIMENTS ON STOPPING TRAINS BY MEANS OF CONTINUOUS BRAKES APPLIED FROM THE REAR, THE DRIVER MERELY SHUTTING OFF STEAM.

This series resembled the last in the fact that the signal to stop was given at the rear of the train, but it differed from it in the driver taking no active part in the stopping of the train, he merely shutting off the steam on feeling that the brakes had been applied. This series of experiments of course threw a very severe strain upon the couplings between the engines and trains, but the speeds at which the trains were run were in most cases moderate, and fortunately there was no case of breaking away.

The first train tried in this series was the London & Northwestern, the brake on both sections of the train being applied by the rear guard in the manner we have already explained. The communication cord was in this instance led through the carriage door handles. The stop made, as recorded in line 41 of our table, was a good one, but the distance run after the application of the brakes as officially stated—namely 600 ft.—does not agree with our own notes, and certainly does not correspond with the time occupied in making the stop. We have, however, adopted the official distance in our table, as in all cases where the brakes were applied at a signal given in the train, and not at a certain fixed point, any notes as to distance run, taken by an unofficial observer, could only be approximate.

We may mention here that after the trial of the London & Northwestern train just spoken of, an experiment was made to determine the possibility or otherwise of working a cord communication along a train of 75 vehicles. For this purpose five of the experimental trains were coupled up, and a cord passed through the door handles on the off side, this cord being led past the engines and tenders attached to the several trains, so that it extended altogether a length of 750 yards, or more than a third of a mile. The long train thus formed stood partly on a straight piece of line and partly on a curve, the cord being led round the convex side, and it was found that under these circumstances a whistle could be sounded on the foremost engine by pulling the cord at the rear. Really, however, this experiment was not of the slightest practical value, as the working of a cord communication on a train at rest is a very different thing to operating it on a train in motion. In the latter case the vertical and horizontal oscillations of the vehicles are continually throwing the cord guides out of line, and thus creating resistances, while the shrinkage caused by a shower of rain and other practical difficulties have to be contended with. Inasmuch as the shrinkage of a new cord on a fifteen-carriage train, such as that sent by the London & Northwestern Company, will amount to 20 feet or so, this is in itself an important matter.

To return, however, to the series of trials with which we are now specially dealing. The next train tried was the Midland, fitted with the Westinghouse automatic brake. With this brake two experiments were made. In the first of these trials (of which particulars will be found in line 50 of our table) the engine and tender brakes were disconnected, and the brakes on the train were applied unexpectedly from the rear, the driver merely shutting off steam when he felt their application. The stop made under these conditions was wonderfully good, as a reference to our table will show. In the other trial the engine and tender brakes were reconnected, and the whole of the brakes were then unexpectedly applied from the rear as before, the driver merely shutting off steam when he became aware of their application. In this case, also, the stop—which was made without any shock—was an excellent one, and altogether, a comparison of lines 39 and 40 in our table with line 33, shows that in the case of the experiment to which the latter refers, the brakes can scarcely have been promptly and effectively applied.

Next in this series came the Lancashire and Yorkshire train, the signal in this case being given to the rear guard, who then applied his brake, the front guard also putting on the brake to his section as soon as he became aware of the application of the brake in the rear. The driver, as in the other experiments on this series, merely shut off steam, the tender brakes not being applied. Next in order came the Caledonian train, the signal in this case being given in the third vehicle from the rear, this being the last vehicle to which the continuous brake was fitted. The two last vehicles of the train were vans with hand brakes, these brakes being applied by the guards on their becoming aware of the application of the continuous brakes. In this experiment, owing, we believe, to the driver being in some apprehension of breaking away from the train, steam was shut off about 16 seconds before the signal was given to apply the brakes, the official time of making the stop as recorded in the vehicle from which the brakes were applied being 21 seconds, as recorded in line 44 of our table, while according to observations made on the engine, steam had been shut off for 36¾ seconds before the train came to a stand. We have before remarked upon the excessive loss of air by leakage which takes place with the Steel & McInnes brake, and we may mention that when the train was about to start on the trial just described, the pump on the engine was working steadily at 74 double strokes per minute to supply this leakage. Unless this state of affairs can be most materially improved, the cost of pumping air for supplying the brake will become no unimportant item.

The only remaining brakes tested in this series of trials were the Smith vacuum brake, and Clark's hydraulic brake, the the Westinghouse vacuum brake on the London, Brighton & South Coast train, and Barker's hydraulic brake not being fitted up for application from the rear. The results attained with the Great Northern train, fitted with Smith's vacuum brake, are recorded in line 43 of our table. The brake in this case was applied from the rear, but the exhauster in the front van was also used. In the case of Clark's hydraulic brake the stop was made by the rear guard pulling a cord connected to a valve on the engine, and thus admitting the water under pressure to the line of pipes and applying the continuous brakes. The results of this trial are given in line 42 of our table.

G.—EXPERIMENTS ON STOPPING TRAINS BY THE USE OF THE ENGINE AND TENDER BRAKES ONLY, THE ENGINE BEING REVERSED WHEN NOT FITTED WITH A BRAKE.

In this group of trials two trains only were experimented upon, namely, the London & Northwestern train, and the Midland, fitted with the Westinghouse automatic brake. In the case of the former the engine was reversed and steam applied against it, but notwithstanding this and the application of the tender brake the train ran nearly two-thirds of a mile, as recorded in line 47 of our table. We may remark that in column 10 on this line the percentage of weight of train resting on the wheels to which the brakes were applied is only that due to the weight of the tender. In reality, however, on the engine being fairly reversed, the weight resting on the coupled wheels also came into play to retard the train. It is this fact which makes the amounts recorded in columns 46 and 47 so high, and gives them really a fictitious value in this particular case.

In the case of the Midland train the engine was not reversed, the engine brake being, however, applied simultaneously with that on the tender by the aid of the Westinghouse apparatus. The results are recorded in line 46 of our table. We may remark that previous to this trial the continuous brakes on the train had been shut off from communication with the engine.

H.—EXPERIMENTS ON THE EFFECT OF PARTING TRAINS WHEN RUNNING BY THE USE OF A SLIP COUPLING.

This was an exceedingly interesting series of trials, and one of considerable importance. Of late years the accidents arising from the breaking away of trains have been numerous, and one of the most important features which it is desirable that a continuous brake should possess. is that under such circumstances it should effectively control the two portions of the parted train. Of the several brakes sent for competition, Clark & Webb's, the Westinghouse vacuum, Clark's hydraulic, and Barker's hydraulic, comprised no expedients for dealing with "break away" accidents. and they, therefore, were withdrawn from the series of trials now under notice. Fay's brake was also generally considered to be useless in such cases (unless indeed the brakes on the several portions were applied by the guards), but Mr. Fay maintained that in the event of a train breaking away by the fracture of a drawbar or its connections, the couplings by which his brake shafts are connected are of sufficient strength to prevent the train from entirely parting. Of course this, even if correct, would only render the arrangement a partial safeguard; as the brake shafts are not coupled up throughout the train, but it was nevertheless determined to test the powers of resistance of the brake shaft couplings. For this purpose the screw couplings and safety chain were detached at one point when the train was standing, and the engine made to move ahead with part of the train. At the first trial the engineman moved ahead too steadily, so that but a very gentle strain was brought upon the shaft coupling, and the Duke of Buckingham, who was standing by watching the experiment, gave instructions that the driver should back up again and take a more sudden snatch at the train. It unfortunately happened, however, that when the front part of the train was backed up the square sliding bar, which serves to connect the adjoining brake shafts, refused to slide in its socket, and it was thus doubled up and the coupling broken. This mishap placed the arrangement for the time *hors de combat*, and the train was therefore sent away and not further tested until the last day of the trials. On that day, however, a "slip" trial was made with this train, the slip coupling being inserted between the tender and the first carriage, and the brakes on the train being applied by hand. Under these circumstances a stop was made with the results recorded in line 49 of our table; but this can scarcely be called a fair "break away" trial, as the results obtained if the break away had occurred in ordinary service, when no special warning had been given to the guards, might have been very different.

The first train tried with a slip coupling was the Caledonian, the train being in this case parted between the third and fourth vehicles from the front, and the detached portion being brought to rest by the action of the continuous brake alone, the hand brakes in the two vans at the rear of the train not being used. The experiment was a satisfactory one, inasmuch as the detached part of the train was duly brought to a stand, the result being recorded in line 50 of our table.

The next train tested was the Great Northern, fitted with Smith's vacuum brake. When this train came up to the starting point, it was found that arrangements had been made by the representatives of the brake to divide it at a particular point near the center, a slip coupling having been fitted there and other preparations made. The Duke of Buckingham, however, together with Mr. Woods and Colonel Inglis, very properly determined to chose their own point for dividing the train, and a slip coupling was therefore inserted behind the second vehicle from the front, Mr. Smith assuring the Commissioners that an efficient stop could be made, notwithstanding that the end of the hose pipe between the carriages would, when the train was parted, remain open. The experiment when made, however, was a thorough failure, the detached portion of the train only being brought to a rest after running 2,509 ft., or nearly half a mile, and this notwithstanding that the speed when the train was divided was only 40½ miles per hour. It was found when the train came to a stand that the carriage wheels were cool, while those of the hind van were hot, and the general conclusion arrived at, therefore, was that the slipped portion of the train had been stopped principally—if not entirely—by the hand brake. We shall have more to say on this point hereafter when dealing with the results of the experiments generally.

The last train subjected to a trial with the slip coupling was the Midland, fitted with the Westinghouse automatic brake, and to those who have studied the details of this arrangement it is scarcely necessary to say that it acted most efficiently. The train was in this instance parted behind the third vehicle from the front, and the portion thus detached was brought easily to a stand in 869 ft., notwithstanding that the speed of the train at the moment of detachment was nearly 53 miles per hour. The results are recorded in line 48 of our table.

I.—EXPERIMENTS TO ASCERTAIN THE RELATIVE PROMPTNESS OF APPLICATION OF THE VARIOUS COMPETING BRAKES.

There is nothing which has been more decisively proved by the various experiments we have been describing than the extreme value of promptitude of action in a continuous brake, especially in the case of stops made from high speeds. According to the programme originally issued by Mr. Woods and Colonel Inglis, it was proposed to test all the brakes at two speeds, namely, 40 and 60 miles per hour, and had this been done some very interesting deductions might have been made. Want of time, however, and some other causes, to which we shall have to advert hereafter, rendered the carrying out of these duplicate trials impossible, and hence some of the deductions as to the relative promptness of the brakes have to be made from the experiments tried when the trains were at rest. These experiments were conducted generally as follows: Mr. Woods standing on the engine foot-plate—or in a van in the case of Fay's brake—gave the order to apply the brake, and at the same time held out a flag which could be seen by observers standing at different points by the side of the train. These observers, on the signal being given, instantly started stop-watches, which they stopped again on the brakes opposite them becoming "set."

The first train thus tried was the London, Brighton & South Coast, fitted with the Westinghouse vacuum brake. In this case the time occupied in bringing the brake blocks on the rear van up to the wheels was 7¼ seconds, but the time required to give the full "nip" was about 11 or 12 seconds. This was too long; but as we have already remarked, the brake on this train was not acting properly. On the same occasion as the time of application of this brake was tested, the train was also uncoupled at one point, all except the brake connections, and the two portions were then drawn apart to show how the hose pipes would detach from each other without injury, the valves with which they are fitted at the same time closing the free ends. The action of these valves was shown to be effective by the brake being applied to that portion of the train which remained attached to the engine. The effect of placing a piece of wood in the end of the hose pipe so as to keep the valve off its seat was also tested, the insertion of a piece about the size of an ordinary pencil between the valve and its seat being found sufficient to prevent the brake from being applied effectively, although the blocks were brought up to the wheels.

The next train experimented upon was that fitted with Barker's hydraulic brake, but this trial showed very irregular results, owing to the stiffness of some of the hydraulic rams, etc. Thus, instead of the brakes going on, or releasing, in regular order from the engine, those rams which worked most freely moved first on the application or release of the pressure, those which were a little stiffer moving next, and so on. Thus the time required to apply the brake to a carriage in the middle of the train was 3 seconds, and to the carriage next the rear van 5¼ seconds, the brake gear of both these carriages being in proper order; while in the case of the rear van it required 12 seconds to apply the brakes. In the same way the brake on the carriage next the rear van was released in about 8½ seconds, while in the case of the carriage near the center of the train, the blocks slowly moved off for 27 seconds.

In the case of the Lancashire & Yorkshire train, fitted with Fay's brake, the blocks were set so close to the wheels that their contact with the latter was almost instantaneous on the giving of the signal. How long it took to bring the full pressure on the blocks could only be observed in the van. In the case of the Steel & McInnes brake the times noted at the rear of the train were 7 seconds and 7½ seconds for the application of the brakes, and 8¼ seconds for their release, the blocks in some of the carriages, however, really continued to move off for 14 seconds.

In the case of the Great Northern train fitted with Smith's vacuum brake, it follows, from the arrangement of the pipes, that the rear blocks are applied the most promptly. A number of observations were made on this train, and the following are some of the results:

Position of Vehicle.	Time taken to apply brakes.	Time taken to release brakes.
	Seconds.	Seconds.
Rear van........................	5	
Middle vehicle...................	9	
" "	10	
3d vehicle from front................	10¼	31¼
2d vehicle from front................	10¾	23
" " "	10¾	22
" " "	10	
" " "	7	27
" " "	8	29½
Front vehicle.....................	14	

A remarkable contrast to the somewhat sluggish action of the vacuum brakes was presented by the Westinghouse automatic arrangement. In the case of this brake the times required to apply and release the blocks were, in repeated experiments, noted as follows:

Position in Train.	Time required to apply brakes.	Time required to release brakes.
	Sec.	Sec.
Front................	instantaneous.	½ to 1
Center................	1¼	2¾
Rear................	1¾	3
"	1⅛	6
"	1¼	3

An experiment was also made as to the time required to make the brake connections between the carriages on this train, and it was found that the hose pipes could be coupled up easily in three seconds. In fact, the hose couplings are so made that they can be connected as promptly as a couple of safety chains.

The time required to apply the brakes on the London & Northwestern train, of course, could not be tested with the train at rest.

* * * * *

GENERAL REMARKS.

The length to which our present notice of the continuous brake trials has already run, and the consequent impossibility of devoting sufficient space to the matter in our present number, compels us to postpone until next week a complete analysis of the various figures we have published, and a discussion of the lessons to be derived from them. We shall, therefore, in our next number return to the subject, and we shall especially point out the deductions to be drawn from the various coefficients given in columns 42 to 47, of our table, these coefficients indicating very clearly the action of the different brakes.

While, however, we are thus compelled to defer our examination of the various figures we have referred to, we cannot conclude our present notice without saying a few words as to the relative practical efficiency of the competing brakes as indicated during the trials.

Practically the competing brakes may be divided into three classes, according to the manner in which the power for ap-

plying the brakes was conveyed through the train. Thus in the first class were Fay's and Clark & Webb's brakes, in which the power was conveyed by direct mechanical connection; secondly, there were the two hydraulic brakes—Clark's and Barker's—in which water under pressure was the transmitting agent; and, thirdly, there were the Smith's vacuum brake, Westinghouse vacuum brake, Steel & McInnes' brake, in which air was turned to account to transmit the power.

Of the mechanical brakes, Fay's, although capable of making good stops when properly adjusted, may be dismissed as not generally available on account of its cost, and the fact that it is quite unfitted for use on trains which have to be frequently broken up and remade. Clark & Webb's again is an improvement on Mr Clark's chain brake, as so long used on the North London Railway, and it certainly does not appear to us to be a brake suited for general application for main line traffic. When used on trains which are kept constantly made up, as is the case on the North London line, and in the London & North-Western trains working between Broad street and the Mansion House, it undoubtedly works well and makes prompt stops, but it is equally undoubtedly a brake which imposes severe strains upon the vehicles to which it is fitted—particularly upon the drawbars—and with less substantial rolling stock than that used on the London & Northwestern and North London lines, these strains would be seriously felt. The brake is also open to the objection that in case of a "break away" it depends upon a cord for its application—a most unreliable thing to depend upon, as experience in other ways has often shown; while another objection is, that the brake can only be efficiently worked in short sections, say, of five carriages each. Thus in the case of the experimental train sent to the recent trials, the front van was taken from its usual position next the tender, and removed four places toward the rear, so that it might work two short sections of the brake, one in front and one behind it. Improved as it has been by Mr. Webb, this chain brake is probably now as perfect as the system will admit of; but the system itself is, we think, one which is not likely to come into general use.

Next as to the hydraulic brakes. The two sent for competition, although differing in detail, were practically identical in principle, and they may, therefore, be considered together. As shown by the experiments and by the results of the working of Mr. Barker's brake on the Great Eastern Railway, this system gives a fair promptness of action, but it has certain drawbacks peculiarly its own. One of them is the liability of the whole affair to be frozen up in winter. We are quite aware that in the system as carried out by Mr. Barker on the Great Eastern Railway, where a supply of salt water is obtained from a special tank in the guard's van, this difficulty is got over; but when the water supply is drawn from the tender, as is the case on the two Midland trains fitted by Mr. Clark and Mr. Barker respectively, strong brine cannot be used, and hence we should apprehend danger from frost. Neither of the hydraulic brakes sent to the competition becomes available automatically in the event of a break away, while neither can be applied from the rear of the train without having recourse to the objectionable cord communication. These are faults which appear to be more or less inherent in the hydraulic system.

Finally, we come to the air brakes. As to the vacuum brake we have already expressed our opinion in this journal. It is no doubt a simple form of brake, and under certain circumstances an effective one; it is, however, very far from fulfilling the numerous conditions which a continuous brake ought to satisfy. Of the two vacuum brake arrangements sent to the recent competition, we ourselves prefer the Westinghouse, notwithstanding that its performances (owing to the defects in the steam supply to the ejector) were not what they should have been. The india-rubber collapsing bags used in Mr. Smith's brake, we consider much inferior to the cast-iron cylinders, not only as regards durability, but especially as regards liability to accidental or intentional damage. Considering how entirely a comparatively small aperture can destroy the action of the vacuum brake the importance of employing durable parts not easily injured is very great. The exhausters fitted by Mr. Smith to his brake vans, and driven from one of the van axles, no doubt do some good during the early part of each stop by emptying the pipes quickly; but considering the small number of revolutions which can be made by each exhauster during a moderately prompt stop and the leakage which takes place in all exhausters when driven at as low speed, the value of these contrivances certainly cannot be regarded as likely to be high in general practice. Neither of the vacuum brakes, we may add, is of any practical use in the event of a break away; while neither can be applied from the rear without the use of the unreliable cord arrangement.

The Steel & McInnes brake, which comes next in our list, is one which we cannot help regarding as more perfect in theory than practice. The idea of carrying a store of compressed air in each carriage and applying the brakes by relieving the pressure in the connecting pipes is undoubtedly good, but the means by which this leading idea is carried out in the Steel & McInnes brake appear to us faulty. The arrangements are especially such as to lead to great, and we fear unavoidable, leakage, while they also fail in giving that promptness of action which is so essential to the efficiency of a continuous brake. The Steel & McInnes brake of course acts automatically in the event of the breaking away of a train, while it can also be applied from the rear or from an intermediate carriage, and so far it forms a step in advance of most of its competitors; but the practical defects we have pointed out constitute objections which we fear it will be difficult to overcome.

Lastly we come to the Westinghouse automatic arrangement, and this we think we may safely say is the only one shown by the recent trials to possess all the requirements of a thoroughly efficient continuous brake. This brake proved far more prompt and powerful in its action than any of its competitors, while it acted perfectly on the train being parted by a slip coupling; and it is moreover capable of being applied from the rear or from any portion of the train at pleasure. It also constitutes, in addition to an efficient brake, an equally efficient signalling apparatus. With no brake on the ground could the breaking up or remaking up of a train be more readily performed, while a spare length of pipe is all that is necessary to enable the brake communication to be led past a carriage not fitted with the apparatus. Excellent as was its performance, too, we do not believe that the Westinghouse automatic brake was seen at its best during the late trials. We ourselves believe it to be a mistake to apply a powerful brake to act upon blocks fitted to one side of each wheel only, and we believe that had the Midland train been fitted with double blocks, the stops made would have been still more prompt. However this may be, the performances, as they stand, were far beyond those of any other brake, as a reference to our table will show. As regards durability and general reliability in every-day practice also, it must be remembered that no brake sent to the recent trials has been so extensively or thoroughly tested as the Westinghouse, and this is a fact which it is well to bear in mind.

We have now concluded, for the present, our remarks on the recent brake competition—a competition which will be long remembered by all who took part in it, and which can scarcely fail to make its mark upon the railway practice of the immediate future. With some of the chief theoretical deductions to be drawn from the experiments, we shall, as we have already stated, deal next week.—*Engineering.*

RESULTS OF EXPERIMENTS ON CONTINUOUS BRAKES CARRIED OUT ON THE MIDLAND RAILWAY.*

Reference Number.	Class of Experiment.	NAME OF LINE TO WHICH TRAIN BELONGED.	BRAKE WITH WHICH TRAIN WAS FITTED.	WEIGHTS. Total Weight of Train.	WEIGHTS. Approximate Weight Resting on Wheels to which Brakes were Fitted.	WEIGHTS. Percentage of Weight of Train Resting on Wheels to which Brakes were fitted.	BRAKE BLOCKS ON ENGINE, TENDER AND TRAIN. Total Number of Wheels in Train.	BRAKE BLOCKS ON ENGINE, TENDER AND TRAIN. Total Number of Wheels to which Brakes were Applied during Trial.	BRAKE BLOCKS ON ENGINE, TENDER AND TRAIN. Total Number of Brake Blocks Applied during Trial.	Speed of Train when Brakes were Applied.	Time Occupied in Making Stop.	Distance Run after Application of Brakes.	State of Rails.	Foot-Tons of Energy in Train at Moment of Application of Brakes.	Equivalent Distance which would have been Run by the Train, if the Speed, when the Brakes were applied, had been 50 Miles per hour.	REMARKS.	Reference Number.
1	2	3	4	8	9	10	15	16	17	36	37	38	39	40	48	49	0
				tons. cwt. qr.	tons. cwt. qr.	per ct.					sec.	ft.	dry.	ft.-tons.	ft.		
1	A	London & Northwestern......	Clark & Webb's..............	241 9 1	39 17 1	16.5	102	14	22	49½	63	2389	dry	19,852	2437	....	1
2	A	Caledonian..................	Steel & McInnes'............	197 7 1	40 12 1	20.5	72	14	14	49½	85	3205	dry	16,225	3270	....	2
3	A	Midland.....................	Clark's hydraulic...........	198 4 0	44 5 0	22.3	72	14	14	49½	83	3265	wet	16,205	3331	....	3
4	A	Great Northern..............	Smith's vacuum..............	257 12 2	55 11 0	20.2	98	18	18	49½	87	3591	wet	21,181	3664	....	4
5	A	London, Brighton & S. Coast..	Westinghouse vacuum.........	204 3 0	46 17 2	20.9	72	14	14	49½	96	3705	wet	16,785	3780	....	5
6	B	Midland.....................	Westinghouse automatic......	203 4 0	164 19 2	81.1	72	66	70	56	22	1020	dry	21,382	813	....	6
7	B	Midland.....................	Clark's hydraulic...........	198 4 0	116 4 0	58.7	72	46	78	54½	21	1070	dry	19,754	901	....	7
8	B	Lancashire & Yorkshire......	Fay's.......................	186 13 0	158 15 1	85.0	72	66	66	48½	24	1016	dry	14,732	1080	....	8
9	B	Great Northern..............	Smith's vacuum..............	257 12 2	225 1 2	87.3	98	92	92	47½	28	1200	dry	19,503	1330	....	9
10	B	London & Northwestern......	Clark & Webb's..............	241 9 1	150 7 1	62.2	102	66	126	49½	31	1384	dry	19,852	1412	Train part'd between the 7th and 8th vehicles while making this stop, draw hook being broken.	10
11	B	Midland.....................	Barker's hydraulic..........	210 2 0	171 15 2	81.7	72	66	118	49½	34	1628	dry	17,274	1661	....	11
12	B	London, Brighton & S. Coast..	Westinghouse vacuum.........	204 3 0	168 1 2	81.8	72	66	66	54½	46½	2200	dry	20,347	1852	....	12
13	B	Caledonian..................	Steel & McInnes'............	197 7 1	161 11 1	81.8	72	66	66	49½	46¼	2135	dry	16,225	2178	....	13
14	C	Midland.....................	Westinghouse automatic......	203 4 0	191 10 3	94.3	72	70	74	52	19	913	dry	24,304	844	....	14
15	C	Midland.....................	Clark's hydraulic...........	198 4 0	141 15 3	71.5	72	50	82	52	22¾	1212	dry	23,706	1121	....	15
16	C	Lancashire & Yorkshire......	Fay's.......................	186 13 0	158 15 1	85.0	72	66	66	44½	27½	1165	wet	12,402	1471	....	16
17	C	Great Northern..............	Smith's vacuum..............	262 6 2	250 8 2	95.5	98	96	96	49½	29	1448	dry	21,565	1477	During this trial the Great Northern train was hauled by the Northeastern engine.	17
18	C	London & Northwestern......	Clark & Webb's..............	241 9 1	124 17 1	51.7	102	54	102	47½	29	1337	dry	18,279	1481	....	18
19	C	Midland.....................	Barker's hydraulic..........	210 2 0	198 5 3	94.4	72	70	126	50¾	32	1549	dry	18,158	1503	....	19
20	C	London, Brighton & S. Coast..	Westinghouse vacuum.........	204 3 0	192 18 1	94.5	72	70	70	52	34½	1728	wet	24,417	1598	....	20
21	C	Caledonian..................	Steel & McInnes'............	197 7 1	161 11 1	81.8	72	66	66	49½	34¼	1603	wet	16,225	1636	....	21
22	D	Midland.....................	Westinghouse automatic......	203 4 0	191 10 3	94.3	72	70	74	52	18	840	dry	24,304	777	....	22
23	D	Lancashire & Yorkshire......	Fay's and Smith's vacuum on engine and tender............	203 12 1	191 14 1	94.2	72	70	70	57¼	28	1400	dry	22,392	1007	Lancashire and Yorkshire train drawn in this experiment by Northeastern engine.	23
24	D	Great Northern..............	Smith's vacuum..............	257 12 2	225 1 2	87.3	98	92	92	45½	22	920	dry	17,895	1111	First experiment. Engine reversed.	24
25	D	Lancashire & Yorkshire......	Fay's.......................	186 13 0	158 15 1	85.2	72	66	66	45½	22	928	wet	12,965	1121	Engine reversed. Brakes of rear section of train believed to have been slig'tly appl'd before sign'l	25
26	D	London & Northwestern......	Clark & Webb's..............	241 0 1	124 17 1	51.7	102	54	102	46½	22¼	979	dry	17,555	1132	....	26
27	D	Midland.....................	Barker's hydraulic..........	210 2 0	198 5 3	94.4	72	70	126	49½	25	1116	dry	17,274	1139	....	27
28	D	Caledonian..................	Steel & McInnes'............	197 7 1	161 11 1	81.8	72	66	66	49½	24	1135	dry	16,226	1158	....	28
29	D	Great Northern..............	Smith's vacuum..............	257 12 2	225 1 2	87.3	98	92	92	42¾	20	860	dry	15,797	1177	Second experiment. Engine reversed.	29
30	D	London, Brighton & S. Coast..	Westinghouse vacuum.........	204 3 0	192 18 1	94.5	72	70	70	49½	31	1548	dry	16,797	1579	Steam brake on engine did not act.	30
31	E	London & Northwestern......	Clark & Webb's..............	241 9 1	141 17 1	58.7	102	62	118	50¾	24¾	1096	dry	20,863	1064	Engine reversed..................	31
32	E	Caledonian..................	Steel & McInnes'............	197 7 1	161 11 1	81.8	72	66	66	46½	23	970	wet	14,351	1122	Engine reversed..................	32
33	E	Midland.....................	Westinghouse automatic......	203 4 0	191 10 3	94.3	72	70	74	48½	22	1082	dry	16,117	1150	Brake in this trial not applied promptly.	33
34	E	Lancashire & Yorkshire......	Fay's.......................	186 13 0	158 15 1	85.2	72	66	66	45½	27	1095	dry	12,965	1322	....	34
35	E	Great Northern..............	Smith's vacuum..............	257 12 2	225 1 2	87.3	98	92	92	43½	24½	1038	dry	16,356	1371	Repetition of the experiment recorded in line No. 38, after cord had been specially adjusted.	35
36	E	Midland.....................	Clark's hydraulic...........	198 4 0	141 15 3	71.5	72	50	82	50¾	27	1429	dry	17,129	1387	....	36
37	E	London, Brighton & S. Coast..	Westinghouse vacuum.........	204 3 0	192 18 1	94.5	72	70	70	49½	32	1517	wet	16,785	1548	....	37
38	E	Great Northern..............	Smith's vacuum..............	257 12 2	225 1 2	87.3	98	92	92	42¾	38	1870	wet	15,797	2192	Signal said to have been misunderstood. Trial repeated.	38
39	F	Midland.....................	Westinghouse automatic......	203 4 0	191 10 3	94.3	72	70	74	54½	20	930	dry	20,252	783	....	39
40	F	Midland.....................	Westinghouse automatic......	203 4 1	140 17 2	69.3	72	60	64	40½	16	600	dry	11,184	914	Engine and tender brakes not used.	40
41	F	London & Northwestern......	Clark & Webb's..............	241 9 1	119 0 0	49.3	102	56	112	39½	15	600	dry	12,638	961	Tender brake not used............	41
42	F	Midland.....................	Clark's hydraulic...........	198 4 0	90 4 0	45.7	72	40	72	49½	28½	1315	dry	16,312	1342	Tender brake not used............	42
43	F	Great Northern..............	Smith's vacuum..............	257 12 2	195 12 0	75.9	98	86	86	42¾	23¼	1088	dry	15,797	1488	Tender brake not used............	43
44	F	Caledonian..................	Steel & McInnes'............	197 7 1	134 19 0	68.4	72	60	60	48½	21	1509	dry	15,576	1604	Tender brake not used, but steam shut off before signal.	44
45	F	Lancashire & Yorkshire......	Fay's.......................	203 12 1	136 17 3	67.2	72	60	60	42¾	31	1200	dry	12,485	1642	Train drawn by Northeastern engine. Engine and tender brakes not used.	45
46	G	Midland.....................	Westinghouse automatic......	203 4 0	50 12 2	24.9	72	10	10	43½	69	2278	wet	12,902	3010	....	46
47	G	London & Northwestern......	Clark & Webb's..............	241 9 1	22 17 1	9.5	102	6	6	43½	94	3299	wet	15,353	4359	Engine reversed..................	47
				Slipped	portion		Slipped	portion									
48	H	Midland.....................	Westinghouse automatic......	111 15 0	111 15 0	00	48	48	48	53¼	16½	869	dry	10,558	766	....	48
49	H	Lancashire & Yorkshire......	Fay's.......................	136 17 0	136 17 0	100	60	60	60	42	25	1007	dry	8,041	1427	....	49
50	H	Caledonian..................	Steel & McInnes'............	108 0 0	94 0 0	87.0	48	40	40	45½	28¼	1320	dry	7,502	1594	Hand brakes in vans not used.....	50
51	H	Great Northern..............	Smith's vacuum..............	169 12 0	169 12 0	100	74	74	74	40½	65	2509	dry	9,335	3285	Train eventually stopped by hand brakes.	51
1	2	3	4	8	9	10	15	16	17	36	37	38	39	40	48	49	0

*The figures at the head of each column are the numbers of the columns in *Engineering's* table, which we have greatly condensed.